PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

~~VOLUME V.~~

Vol. V, VI.

~~1873–1874.~~

SAN FRANCISCO:

JUNE, 1875.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

ADDITIONAL CORRECTIONS TO (*LAST*) VOLUME IV.

On page 280, in Donations to the Museum, read *Astacus Oregonense*, instead of *Asaphus Oregonense*.

Same page, sixth line from bottom, for *specimens* read *species*.

NOTE.—VOLUME IV.

☞ In Plate I, *Amphissa (? versicolor*, Dall, *var.) lineata*, Stearns, the shell, fig. 8, is represented too heavy and too dark; it is almost of porcellanous whiteness, and the fine transverse lines are nearly black.

In the same plate, fig. 10, *Mangelia interlirata*, Stearns, the transverse sculpture is represented as crossing the longitudinal ribs, which is not correct: vide description.

the Academy, of which the following is a summary: Amount received from monthly dues and life memberships, to date, $2,702.35; the disbursements for the same time amount to $1,133.90; leaving,

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

ANNUAL MEETING, JANUARY 6TH, 1873.

President in the Chair.

Thirty-eight members present.

Robert M. Brereton was elected a life member, and Theodore A. P. Brown, C. B. Morgan, P. Hatch, M.D., and S. B. Boswell, were elected resident members.

The President delivered his annual address, referring to the progress and prospects of the Academy, and its claims to public consideration.

The Director of the Museum, Curator of Entomology, and Librarian, submitted their annual reports, which were read and accepted.

The Treasurer presented his exhibit of the financial affairs of the Academy, of which the following is a summary: Amount received from monthly dues and life memberships, to date, $2,702.35; the disbursements for the same time amount to $1,133.90; leaving,

a balance on hand, of $1,568.45. On motion, the report was accepted and ordered filed.

The annual election being now in order, the following gentlemen were elected officers of the Academy for the current year:

PRESIDENT.

GEORGE DAVIDSON.

VICE-PRESIDENT:	TREASURER:
JOHN HEWSTON, JR.	ELISHA BROOKS.
CORRESPONDING SECRETARY:	RECORDING SECRETARY:
HENRY G. HANKS.	CHARLES G. YALE.
LIBRARIAN:	DIRECTOR OF MUSEUM:
C. N. ELLINWOOD, M.D.	H. G. BLOOMER.

TRUSTEES.*

ROBERT E. C. STEARNS.	OLIVER ELDRIDGE.
THOMAS P. MADDEN.	D. D. COLTON.

Dr. Stout read a paper "On the Chemistry of Great Fires," referring more particularly to certain phenomena connected with the recent disastrous fire at Boston. The views advanced by Dr. Stout elicited much discussion, Dr. Blake and others dissenting.

Regular Meeting, January 20th, 1873.

President in the Chair.

Forty members present.

J. P. Jones, A. A. Gansl, Tiburcio Parrott, and George T. Marye, Jr., were elected life members; and S. P. Middleton, and E. L. Beard, resident members; Montgomery P. Fletcher, and Caspar Schenck, were elected corresponding members.

Robt. E. C. Stearns was elected a life member, on recommendation of the late Trustees, in recognition of services rendered to the Academy.

* The President, Treasurer and Recording Secretary, are Trustees *ex-officio*.

Donations to the Library: Proceedings of the Entomological Society of France, 1868–9. Bulletin Meteor., Mensuel de l'Observatoire de l'Université d'Upsal, Vol. I, Nos. 1–12. Vol. III, Nos. 7–12. Bulletin de l'Acad. Imperiale des Sciences de St. Petersburg, Tome XVII, Nos. 1, 2, 3. Memoires de l'Acad. Imp. des Sciences de St. Petersburg, VII Serie, Tome XVII, Nos. 11, 12. Tome XVIII, Nos. 1–6. Archives Neerlandaises des Sciences Exactes et Naturelles de la Société Hollandaise des Sciences a Harlem, Tome VII, Livraisons 1, 2, 3. Tome VI, Liv. 4 and 5. Giebel's Zeitschrift fur die Gesammten Naturwissenschaften, new series, Bandes I, II, III, IV. Schriften aus Dem Gauzen Gebiete der Botanik herausgegeben vom Kaiserlichen Bot. Garten, Band II, Hft. 1, St. Petersburg, 1853. Zeitschrift der Deutschen geologischen Gesellschaft, Band XXIII, Hft. 4. Band XXIV, Hft. 1–2. Ab handlungen, Herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft, Vol. VIII, Parts I, II. Abhandlungen der Naturhistorischen Gesellschaft zu Nurnberg, Band V. Memoires Royal Bot. Garten St. Petersburg, Tome I, Part I. Acta Universitatis Lundensis 1868, Parts 1–3; also 1869, Parts 1–2; and 1870, Parts 1–2. Jahrbuch der Kaiserlish-Koniglichen Geologischen Reichsanstalt, Band XXII, Nos. 1–2. Verhandlungen der k.k. geol. Reichsanstalt, Nos. 1–7. Revista Med. Quirurgica de la Association Medica Bonaerense, Año 9, No. 6. Catalogus Systematicus Bibliothecæ Horti. Imp. Bot. Petropolitani. Sertum Petropolitanum seu Icones et descrip. plantarum, quæ in Horto Bot. Imp. Petropolitano, Fas. I–IV. Elfter Bericht, Offenbacher Vereins fur Naturkunde im Vereinsjahre, 1870–1871. Sitzungs-Berichte der Natur-wissenschaftlichen Gesellschaft Isis in Dresden, Jahrgang, 1871–72. Animadversiones Botanique of the Acad. Petropolitani, p.p. 1–24, and p.p. 41–59. Enumeratio Plantarum Novarum a Cl. Schrenck: Moscow, June, 1841, and October, 1842. Bericht uber die Sitzungen der Naturforschenden Gesellschaft zu Halle in Jahre, 1870, Jan. and Feb. Uebersicht der Aemter-Vertheilung und wissenschaftlichen Thatigkeit des Naturwiss. Vereins zu Hamburg Altona im Jahre, 1869–70. Bericht uber die Senkenbergische naturforsche Gesellschaft, 1870–1871. Die unseren Kulturpflanzen schadlichen Insekten, by Gustav Kunstler, Wien, 1871. R. Comitato Geologico d'Italia, Bolletino Nos. 7, 8, 9, 10, 1872. Die Grundlagen des Vogelschutz-gesetzes von G. R. von Frauenfeld, Wien, 1871, Part I, July 1871; Part II, October 1871. Die Pflege der Jungen bei Theiren-Zwei Vor. von G. R. v. Frauenfeld, Wien, 1871. Proc. Philos. Soc., Glasgow, 1871–72. Trans. Edin. Geol. Soc., Vol. II, Part I, 1872. Belfast Nat. Field Club, 6th Report, 1868–9; 8th Rep., 1870–71; 9th Rep., 1871–72. Proc. Imp. Russ. Geog. Soc., Nos. 1–8, Vol. VII, 1871; Nos. 1–3, Vol. VIII, 1872. Sitz der Kaiser-Akad. Wissen, Parts I and II, III, IV and V, Vol. LXIV (2 sets), Wien, 1871. Monat. der König. Preuss. Akad. der Wissen du Berlin, Parts for April, May, June and July, 1872. Abhand-heraus von Naturwissen-schaftlichen Ver. zu Bremen, Parts I and II, Vol. III, 1872. Zeit. du Deutsch. Geolog. Gesellschaft, Part IV, Vol. XXIII; Parts I and II, Vol. XXIV, Berlin, 1871. Die Uns. Kutturpflanzen schäd. Insekten, Gustav Künstler, Wien, 1871. Ber. über der Senck.

Naturforschende Gesellschaft, 1870–71, Frankfort a. M. Abhand. der Naturhistor. Gesell. zu Nürnberg, Vol. V, Nürnberg 1872, Zeit. furdie Gesammten Natur. New series, Vols. I and II, for 1870; III and IV, for 1871. Berlin 1871. Shrift. der König. Physikalisch-Pkonomischen Gesell. zu Königsberg, Parts I and II, for 1871; Part I for 1872. Königsberg, 1872. Bulletin Soc. Imp. des Natur de Moscow, Nos. I, and III–IV, for 1872, Moscow, 1872. Verhand. des Naturhist. Vereines der Preuss. Rhein, und Westph, 3d series, Part I, of 9th year, Bonn 1872. Mem. L'Acad. Sci. de St. Peters, 1st Series, Vol. XVIII, No. 1. Arch. Néerland. Sci. Exact. et Natur, Parts 4 and 5, Vol. VI, 1871; Parts 1, 2 and 3, Vol. VII, 1872; La Haye, 1871. Der Zoöl. Gart., Nos. 1–6, 1872, Frankfort, a. M., 1872. Bulletin Soc. Sci. Hist. et Natur. de L'Yonne, 25th and 26th Vols. for 1871, 1872. Denk. der Kaiser. Acad. der Wissen, Vol. XXXI, Wien, 1872. Abhand. Senck. Natur-Gesell., Parts I and II, Vol. VIII. Frankfort a. M., 1872. Jahr. Kaiser. König. Geol. Reich., Nos. for April, May, June, Vol. XXII, for 1872, Wien, 1872. Revista. Med. Quirurg, Assoc. Méd. Bonaerense, Buenos Aires, 1872. Verhand der K. K. Geol. Reich., No. 1, 1872, Vienna. Ber. ub die Sitz. der Natur. Gesell. zu Halle, for 1870, Halle. Uebersicht u. s. w. Naturwissen. Vereins zu Hamburg—Altona, 1869, 1870. Die Pflege der Jungen-bei Thierén, Wien, 1871. Acta Univers. Lundensis; Philos., 1868; Mathew, 1868; Lund., 1868–9. Bulletin Météor, u. s. w. l'Univers, d'Upsal., Nos. 1–12, Vol. I, Upsal, 1871. Nova Acta. Reg. Soc. Scien. Upsal, Part 1, Vol. VIII, 1868–9; 3d Series, 1871. Upsal, 1871.

Donations to the Museum: Specimen of Durangite, from Durango, Mexico, by Henry G. Hanks.

Mr. Hanks, in presenting the above mineral, remarked that it was supposed to exist in considerable quantity in Durango; that heretofore it had been quite rare; it had no special value, and is prized only as a curious formation.

Dr. Gibbons exhibited specimens of tape-worms engendered in the system of a child. These worms were of a peculiar form, and Dr. Gibbons supposed they were caused from raw meat having been fed to the child for some disease of the bowels. They were beef tape-worms (*Tænia mediocanellata*); the child recently began to discharge isolated worms presenting a notched joint at one end, and the other end rounded more like a head. On further examination under the microscope, the head in one specimen was found to protrude half an inch. No description of the isolated creature was found in the books by Dr. Gibbons. It differs from the ordinary detached segments of tape-worm in the apparent possession of a head at the rounded extremity, approaching in this respect the

cysticircus, or imperfectly developed worm, as it is found in the animal tissues. It appears to hold a middle place between the cysticircus and perfect worm as found in the intestines.

New Problems in Mensuration.*

BY GEORGE DAVIDSON.

9. Given the diameter of a sphere, to find the diameters of any number of concentric shells and the central sphere having equal volumes with each other, into which the given sphere is divided.

To divide it into n shells and the inner sphere, let d represent the diameter of the given sphere; x, y, z, etc., the diameters next interior; $(w\text{–}1)$ and w the diameters of last shell and inner sphere; then,

$$x^3 = \frac{(n-1)\ d^3}{n} \quad : \qquad y^3 = \frac{(n-2)\ d^3}{n} \quad : \quad \text{etc.}$$

$$(w=1)^3 = \frac{2\,d^3}{n} \quad : \qquad w^3 = \frac{d^3}{n}$$

10. Given the diameters of a spherical shell, to find the diameters of any number of concentric shells into which it is divided, they having equal volumes with each other.

To divide it into p shells, let d' represent the exterior diameter; d the interior diameter; x, y, z, etc., the diameters reckoned from d' towards d; $(w\text{–}1)$ and w the last two diameters; then,

$$x^3 = \frac{d^3 + (p-1)\ d'^2}{p} \quad : \qquad y^3 = \frac{2\,d^3 + (p-2)\ d'^3}{p} \quad : \text{etc.}$$

$$(w\text{–}1)^3 = \frac{(p-2)\,d^3 + 2\,d'^3}{p} \quad : \qquad w^3 = \frac{(p-1)\ d^3 + d'^3}{p}$$

11. Given the diameters of a spherical shell, and having divided it into any number of concentric shells of equal volumes with each other, to find the diameters of the consecutive outer shells of equal volumes with the subdivided shell.

Let d', d; x, y, etc., represent the quantities as before; p the number of shells into which the given shell is divided; n the required number of outer shells, and o', o'', o''', etc., the consecutive diameters of these shells; then,

$$o_n^3 = \frac{(n+p)\ d'^3 - n\,d^3}{p}$$

12. Given the diameter of a spherical shell, and having divided it into any

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* In continuation of former problems; *vide* Vol. IV, pp. 278, 290. NOTE.—Please note the following typographical errors in said problems: Page 290, second line from bottom, for "n^2," read "x^2."; page 290, last line, for "w," read "w^2."

number of concentric shells of equal volumes with each other, to find the diameters of the consecutive inner shells of equal volumes with the subdivided shell.

Let d', d; x, y, etc., and p, represent the quantities as before; n the required number of inner shells, and i', i'', i''', etc, the consecutive diameters of these shells; then,

$$i_n^3 = \frac{(n + p)\, d^3 - n\, d'^3}{p}$$

Dr. Stout submitted specimens of iron sands, such as he had exhibited at a previous meeting. A microscopic examination was made by the members, and a discussion as to the formation, deposition and occurrence of these sands, was participated in by Drs. Stout and Gibbons; also by Prof. Davidson, who mentioned their occurrence in the neighborhood of the Chilchat River; and Mr. Dall, who spoke of samples of black sand from Alaska, sent to him some time ago for examination, which he was surprised to find contained hardly any magnetite.

Regular Meeting, February 3d, 1873.

President in the Chair.

William E. Brown, Frederick H. Waterman, Rev. W. A. Scott, D.D., were elected resident members.

Hon. C. E. DeLong, and Albert Bierstadt, were elected corresponding members.

Donations to the Library: Report of the Medical Society of California, for 1871–2. Transactions and Proceedings of the New Zealand Institute, 1871, Vol. IV; Fishes of New Zealand, etc., by F.W. Hutton, and Notes on the Edible Fishes of New Zealand, by James Hector, M. D., presented by Victor Hector. Proceedings Agassiz Institute of Sacramento, 1872.

Donations to the Museum: A barbed instrument, made by the natives of Kotzebue Sound, from A. Honcharenko. Specimen of silver ore from the Raymond and Ely mines. Specimens of "ce-

ment" and "bed-rock," from the gravel of Long Cañon, near Michigan Bluff, Placer county, by Dr. J. M. Willey.

Mr. Stearns read the following paper:

Remarks on a New Alcyonoid Polyp, from Burrard's Inlet.

BY ROBERT E. C. STEARNS.

At a meeting of the Academy held on the 17th July, 1871 (see Proceedings, Vol. IV, page 180,) in referring to a donation to the Museum, made on the previous 5th of June, of what resembled a bundle "of dried willow switches" from Burrard's Inlet, our fellow member, Dr. Blake, regarded them, as I infer from the brief published abstract of his remarks, as pertaining to a new species of sponge. The exceedingly meagre data in our possession at present, preclude any positive conclusion as to the true position of these apparent "rods or switches of bone," for on referring to our records I see that the specimens were sent "with no information accompanying them, except that they were 'skeletons of some kind of fish!'" At the time of the donation, "It was thought by some to be the internal structure of a species of zoöphyte, allied to Virgularia."

With the specimens alone, and without any knowledge of the fleshy or soft parts, and no particulars as to physiognomy or habit of the organization of which each of these switch-like forms is a part, we can only reason from analogy, and not with satisfactory definiteness.

It is quite certain that they are not the back-bones, and quite unlikely that they are fin-bones of any species of fish; as between zoöphytes and sponges, to which latter Dr. Blake regards the specimens as allied, I am decidedly of the opinion, after an examination of the limited authorities at my command, that they belong to a species of zoöphyte, and are included within some one of the groups of the Order of Alcyonoid Polyps.

"The solid secretions of these polyps are of two kinds: Either (1) internal and calcareous; or (2), epidermic, from the base of the polyp. The latter make an axis to the stem or branch, which is either horny * * * * or calcareous. A few species have no solid secretions.

All the species are incapable of locomotion on the base; yet there are some that sometimes occur floating in the open ocean."*

In the third division of the Alcyonoid Polyps, following Prof. Dana's classification, we have the "*Pennatula tribe,* or PENNATULACEA. These are compound alcyonoids, that instead of being attached to rocks, or some firm support, have the base or lower extremity free from polyps and buried in the sand or mud of the sea-bottom, or else live a floating life in the ocean. Their forms are very various."†

After referring to certain species of the *Veretillidæ,* their structure and beauty, other forms are mentioned belonging to the Pennatula tribe, some of

* Dana; Coral and Coral Islands, pp. 80, 81.

† Ibid., page 91.

which, like the group Pennatulidæ, have a stout axis, with branches either side, arranged regularly in plume-like style, or a "very slender stem and very short lateral polyp-bearing pinnules or processes along it (the Virgularidæ); * * * and some of these have a slender stem, and the polyps arranged along one side of it (the Pavonariadæ); and still others a terminal cluster of polyps (the Umbellularidæ).

The most of these species secrete a slender horny axis, and have slender calcareous spicules among the tissues, somewhat like those of Gorgonidæ."*

This internal *horny* axis is also described as "bony"† by other writers; it is covered with a fleshy substance, of a consistence like that of the Actinia, which, being largely composed of water, leaves but little solid matter when dried, which is brushed off or crumbles away with very little handling.

In the Pennatulæ, or Sea-pens, the central stalk or axis is of moderate length and the pinnæ rather long, presenting the appearance of a feather; or as Lamarck said, "it seems, in fact, as if nature, in forming this compound animal, had endeavored to copy the external form of a bird's feather."

"In some genera, *Virgularia* and *Pavonaria*, to which the name of "sea-rushes" has been given, the central stem is very much prolonged, some of them measuring between three and four feet in length. The polypiferous lobes are comparatively short." §

To either the sea-pens (Pennatulidæ), or the Umbellate corals (Umbellularidæ), I believe these specimens belong; and of the two groups indicated, I am inclined to place them in the latter; said group is characterized by a "Polypary free, simple elongated, with the polyps at the summit; axis stony, inarticulate, covered with a fleshy cortex; polyps large, terminal, arranged in an umbellate manner at the end of the polypary."‡

Figuier remarks that "Les Ombellulaires ont une tres-longue tige, soutenue par un os de même longueur et terminée au sommet seulement par un bouquet de polypes."‖

"The physiological phenomena which the Pennatula present is extremely interesting, since it exhibits the example of a truly composite animal, that is, one in which animals, more or less in number, really perfect so far as comports with the grade of organization to which they belong, form part of a common living * * * body, serving as an intermedium for nutrition to all the individuals, so that they are all nourished together in a mediate manner by means of this common portion of which they form a part.

The nutriment which favorable circumstances have placed within the reach of one individual, nourishes that individual first, and then, by extension, nourishes the common stem; and thus the other polypi, which constitute organic portions of it, receive their share."¶

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* Ibid, page 91.
† Dallas, in "Orr's Circle of the Sciences."
§ Dallas, Ibid.
‡ Manual Nat. Hist. Travellers, page 357.
‖ La Vie et les Mœurs des Animaux, Paris, 1866.
¶ Cuvier; Mollusca and Radiata, by Griffith and Pidgeon. London, 1834.

Or in other words, the nutrition which is secured or received by an individual polyp, is diffused through and nourishes the whole.

After a consideration of the subject, with the specimens before us, I think the analogies strongly favor a reference to one or the other of the groups I have indicated, instead of the fishes or sponges, to either of which I cannot perceive they hold the slightest relationship.

From the coast of Greenland, Lamarck has described a species of Umbellularia (U. Grœnlandica,) and we might perhaps, with some degree of reason, look for a related form upon the Pacific side, in some northern station where the physical conditions measurably correspond to those of the habitat of the north Atlantic species cited.

It will be readily perceived, that before an accurate determination can be arrived at, the living forms, of which I believe these "switches" are the central stalks or axes, must be studied *in situ*, as it is quite doubtful whether the fleshy portion can be preserved.

At a meeting of the Academy subsequent to the date of Dr. Blake's remarks to which I have alluded, reference was made to a communication by Mr. Sclater, in the scientific weekly publication, "Nature," bearing upon this subject.

After writing down the conclusions which I have just read, through the courtesy of Dr. Hewston, I was enabled to examine a file of that publication, and I find that Mr. Sclater read a paper before the British Association, at the Brighton meeting, August 20th, 1872,* in which he acknowledges the receipt of several specimens of these "switches," from Captain Herd, of the Hudson's Bay Company, with a statement from the Captain that, "These rods are the backbones of a sort of fish found in great abundance at Burraud's Inlet, Washington Territory, North-west America, whence they have been brought by two Captains in our service. These animals are shaped like a Conger eel, but are quite transparent, their bodies being composed of a mass of jelly — they are about 8 inches in diameter. The head is like a shark's head: it is attached to the thick end of the rod — it has two eyes and a mouth placed low down. The backbone is also transparent in the living animal, but becomes hard when dried on the beach by the sun. These fishes swim about in shoals, along with the dog-fishes." Other information was received by Mr. Sclater, of the same tenor.

A specimen of the switches was sent by Mr. Sclater to Prof. Kolliker, of Wurzburg, who had shortly before been engaged in monographing the Pennatulidæ; and the latter gentleman, in reply, stated his belief, "That the object you sent me * * * is indeed the axis of an unknown Pennatulidæ, etc."

"Prof. Flower, Prof. Milne-Edwards of Paris, and several other Naturalists, who visited the rooms of the Zoölogical Society * * all said that the objects were new to them, and that they did not know what they were, but were mostly inclined to regard them as the axis of an unknown Pennatulide animal."†

From the allusion (in the foot-note) in "Nature" to Dr. Gray, and his refer-

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* See "Nature," Vol. VI, page 436.

† See "Nature"; also foot-note.

ence of one of these switches to a genus (Osteocella) made by him, I quote as follows from page 405, of the Annals and Magazine of Natural History, Vol. IX, (Fourth Series). Dr. Gray refers to the Genus Osteocella as follows: "Mr. Clifton, many years ago, sent * * * to the British Museum, the 'backbone taken out of the marine animal in bottle marked No. 1. I caught him, or it, swimming with great rapidity in shallow water.' The bottle never reached the British Museum; but the backbone did; and I described it at the end of the 'Catalogue of Sea-Pens, or Pennatulidæ, in the British Museum,' published in 1870, under the name of 'Osteocella Cliftoni'; but considered it very doubtful its belonging to the Pennatulidæ."

The British Museum has lately received a very long, slender bone, 64½ inches long and 3-16 inch broad in its broadest part, which was sent to the Zoölogical Society by the Hudson Bay Company, and evidently came from the northern seas, probably from the west coast of America.

Mr. Carter has kindly examined the Australian specimen sent by Mr. Clifton, and the one sent * * by the Hudson Bay Company * * * and finds them, under the microscope, "present the same horny structure, viz., a fibrous trama, more or less charged with oval cells or spaces, quite unlike that of *Gorgonia* and *Pennatula*, which present a concentric mass of horny layers, charged more or less with calcareous crystalline concretions. It is evidently a second species of the same genus, *Osteocella*."

After a few lines, follows a description of the genus

"*Osteocella*, Gray, Cat. of Pennatulidæ (1870), p. 40."

After describing the style, or axis, he refers to the animal (which neither he nor we have seen) in the following words: "Animal or colony of animals free, marine; otherwise unknown; most probably like the Pennatulidæ, but the style is harder, more calcareous and polished than any known style belonging to that group, which are generally square, sometimes cylindrical, but rarely fusiform in the genus *Virgularia;* or, it may be the long conical bone of a form of decapod cephalopod, which has not yet occurred to naturalists, as Mr. Clifton spoke of its being a free marine animal, and it has a cartilaginous apex like the cuttlefish. * * * * It is evident that there are two species of animal yielding this kind of bony substance:

1. *Osteocella Cliftoni.* Thick, about 11 inches long, tapering at each end. From Western Australia.

2. *Osteocella septentrionalis.* Long, slender, about 64 inches long, attenuated at the base, and very much attenuated and elongated at the other end. Northern Seas? Collected by the Hudson's Bay Company."

This latter, undoubtedly refers to the same forms, of which we have numerous specimens in the Academy's Museum, and which are referred to in this paper.

Dr. Gray proceeds and says: "Mr. Carter informs me that subsequent examination of this axis with acid, 'shows that it is similarly composed to that of *Gorgonia*, viz., of kerataceous fibre or substance, and calcareous crystalline matter like that of the stem of *Osteocella Cliftoni*, and the other Pennatulidæ,

which it most nearly resembles'; so that my original view as to the nature of this organ seems to be thus confirmed."

From what is herein quoted from Dr. Gray's paper, it will be perceived, that while the microscopic examination showed it to be "quite unlike that of *Gorgonia* and *Pennatula*," that Mr. Carter's subsequent examination of the second species referred to *Osteocella*, "shows that it is similarly composed to that of *Gorgonia*, * * * and * * * like that of the stem of *Osteocella Cliftoni*, and the other Pennatulidæ," etc.

Dr. Gray's paper implies a collision between the *microscopic test* and the *examination with acid;* and the description of his genus contains a doubt as to which division of the animal kingdom *Osteocella* is related. With high regard for the justly distinguished naturalist, it must be admitted that his genus is quite indefinite, and could be construed to cover a wide range; but as he has attached it to the catalogue of Pennatulidæ, it is perhaps fair to infer that in his mind the balance of reasoning tends in that direction; as between the microscopic and the acid tests, the latter is of insignificant value.

But returning to the "switches," I find that Mr. Sclater does not commit himself, but with apparent consideration for the intelligence of the parties who sent him the specimens and their statement that they belonged to a species of fish, he only says that, "supposing * * * * that these objects are really derived from such an animal as is described and figured above, I can only suggest that they may be the hardened notochords of a low-organized fish, allied either to the Chimæroids or to the Lampreys, in which the notochord is persistent throughout life. It is quite certain, I think, that they cannot be any part of the true vertebral column."

On page 432 of the same number of "Nature," appears an article relating to Mr. Sclater's paper, from Mr. H. N. Moseley, who, after what appears to have been a rather careful examination of the authorities upon the groups to which he thinks it belongs, as well as upon its microscopical structure, expresses an endorsement of Prof. Kolliker's opinion, and closes by saying: "In the mean time I cannot but conclude that Mr. Sclater has been misinformed, and that we are very unlikely ever to see that marvellous fish in the flesh."

Again: in "Nature," of October 24th, 1872,* Mr. J. W. Dawson, Principal of the McGill College, at Montreal, writes that, presuming that the "disputed organism * * is specifically identical with a specimen from Frazer River * * presented * * for the Museum of the University * * *. I at once recognised it as the axis of a Virgularia, or some similar creature * * * *. I submitted it to Prof. Verrill, of Yale College, who had no doubt as to its nature;" and Mr. Whiteaves, of Montreal, noticed it in his report, "as an undescribed Pennatulid."

Then follows Dr. Blake, in "Nature," (of November 28th, 1872)† to which previous reference has been made by me, as it is a part of this Academy's proceedings, in which, as the result of a microscopic investigation, he says: "An

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* Vol. VI, No. 156.

† Vol. VII, page 161.

examination of the specimens * * enables me to refer them to the Protozoa class, Spongidæ, or sponges"; and he concludes by saying: "Its generic relations will, I think, be with Hyalonema and Euplectella, both sponges of the Pacific."

The foregoing is all that I find relating to the "switches," prior to my remarks as above; I was not aware, at the time, that anything had appeared on the subject, other than the remarks of Dr. Blake, and that of Mr. Sclater's article, to which Dr. Blake referred. Mr. Sclater's article I had not read, but had casually glanced at the drawing of the so-called fish.

But having expended so much time prior to an examination of the files of "Nature," I considered it a matter of sufficient interest to warrant a review of the subject, and present the same to the Academy.

As to what these animal "switches" belong to, it will be seen that Dr. Blake, whose examination of their substance microscopically appears to have been quite thorough, places them with the *sponges*. Mr. Sclater does not commit himself, but *conditionally* refers them to the *fishes*. Dr. Gray described (it) them as a new species of *Osteocella*, whatever that may be, (perhaps a *Pennatulid*) while Professors Kolliker, Flower, Milne-Edwards, Mr. Mosely, Principal Dawson, Prof. Verrill, Mr. Whiteaves; Mr. Dall and myself, regard them as belonging to a species of Alcyonoid polyp, related or pertaining to the group *Pennatulidæ*.

On reviewing the above, it will be noticed that the various parties who presented the specimens, both of the Burrard's Inlet forms and that from West Australia, state that they are bones of, or belong to fishes, implying that they are a part of free-swimming animals; while some species of the *Pennatulacea* "live a floating life in the ocean," it is not unlikely that others may not be constantly stationary, or, if I may use the word, are not *planted*, *all* of the time; and while floating might be mistaken for fishes, more especially if numerous specimens were seen moving in the water, coincident with the presence of a school of fishes.

In conclusion, I would state my belief that the much-discussed switches are a species of *Umbellularia*, for which Dr. Gray's specific name might be adopted, and attached to the specimens from Burrard's Inlet, in the Academy's collection.

Mr. Dall presented the following description of new species of Cetacea, belonging to the West Coast of North America:

Descriptions of Three New Species of Cetacea, from the Coast of California.*

BY W. H. DALL, U. S. COAST SURVEY.

Delphinus Bairdii, n. s.

Back, posterior sides, fins and flukes, black. Anterior sides gray, with two narrow white lateral stripes. A white lanceolate belly patch. Dorsal falcate;

* Printed in advance, Jan. 29th, 1873.

beak slender, elongated. Length, six feet seven to nine inches. Length of skull, 18.76 in.; length of beak before the notches, 11.9 in.; height of skull at vertex, 6 in.; greatest breadth at zygomatic process of squamosals, 6.95 in.; breadth between maxillary notches, 3.4 in.; ditto at middle of beak, 2 in. Teeth, $^{48}/_{47}$, the anterior six on each side very small, not projecting above the gums. Two female specimens, Cape Arguello, California, Scammon, 1872; of which one entire skeleton has been forwarded to the National Museum at Washington.

This species belongs to the restricted genus *Delphinus* of Gray, and is peculiar from its extremely attenuated beak and very deep channels on each side of the palate behind. The superior aspect of the skull resembles that of *Clymenia microps*, Gray. It differs from all the described species of the genus in color and osteological characters, and will be fully described in the forthcoming monograph of the Pacific Cetacea, by Capt. C. M. Scammon, U. S. R. M., to whom I am indebted for the opportunity of describing this and the following species. It is dedicated, by request of Capt. Scammon, to Prof. S. F. Baird, of the Smithsonian Institution.

Tursiops Gillii, n. s.

Dull black, lighter on the belly. Dorsal low, falcate. Teeth, $^{23}/_{23}$. Monterey, California. Lower jaw: length from end of beak to condyles, 16.8 in.; do. to end of coronoid process, 15.8 in.; do. to end of tooth line, 9.3 in.; length of symphysis, 2 in.; width between outer edges of condyles, 9.75 in.; between two posterior teeth, 3.5 in.; height of ramus at coronoid process, 4.4 in. The material for identification of this species is unfortunately very small, being only the lower jaw, and outlines of the animal, drawn by Capt. Scammon. It does not appear to have been described, and the only other species of the genus described from the Pacific is the *T. catalania*, Gray, from N. W. Australia, which is described as being lead colored. It is dedicated, by desire of Capt. Scammon, to Prof. Theodore Gill, of the Smithsonian Institution, whose memoirs on the Cetacea and Pinnipedia of the Pacific are already classical.

Grampus Stearnsii, n. s.

Colors dark, but variable: the anterior portion of the body white, and the sides of the body more or less mottled with gray. Dorsal high, and slightly falcate. Animal 12 or 15 feet long; teeth $\frac{0}{3}$ or $\frac{0}{4}$. Coast of California.

Two lower jaws of this animal are in my hands for examination, and but that no *Grampus* has been described from the Pacific, I should hesitate about applying a specific name to them. Gray has, indeed, catalogued a *Grampus* (?) *sakamata* (!) from Japan, based on a Japanese account quoted by Schlegel, but the genus is by no means certain; the descriptions are conflicting, and the species rests on no scientific basis. The jaws referred to are attributed by Captain Scammon to his "white-headed grampus," and measure, from the end of the beak to the condyles, 17.5 in.; ditto to coronoid process, 16.2 in.; height of ramus at coronoid process, 5 in.; length of symphysis, 2 in.; height of gonys, 2 in.; width between outer corners of condyles, 14 in.; ditto at inferior dental

foramen, 7 in. Teeth in one specimen three, and in the other four on each side near the tip, pointed, solid, shaped like an orange seed, and extending forward and outward.

Fuller descriptions of this and the last species will be given in the work referred to. The present species is dedicated, by Capt. Scammon's wish, to Mr. R. E. C. Stearns, of San Francisco, well known for his researches in Natural History.

Remarks on the Auriferous Gravel Deposits in Placer County.

BY J. M. WILLEY, M. D.

Having had occasion, in August last, to visit the celebrated mining region which centres in Forest Hill, I went with expectation of finding confirmation of the usual theory concerning the formation of this gravel deposit.

It is hardly necessary to say, that the gravel beds of the central counties of California are supposed to present sufficient evidence of the existence of a system of large but extinct rivers; and that the course of these ancient rivers is believed to have been oblique, and often at right angles to that of the present streams, and to their tributaries, flowing through the various cañons which have their sources on the western slopes of the Sierra Nevada range.

Although it is possible that such a mode of explanation may account for even so widely spread a deposit of gold-bearing gravel as exists in Placer and adjoining counties, I think there are certain features in this deposit difficult to reconcile with the theory of the ancient river system, and that a closer study of the subject reveals a problem of a very complicated, though interesting nature.

The first thing that arrests the attention, after looking at the large excavations which hydraulic power has worn in the gravel banks, in some places leaving precipices from one to two hundred feet deep, is the profusion of boulders of pure quartz, which cover the worked-out portions of the ground. These boulders lie on the bed rock, in some places many feet in depth. At Forest Hill and Michigan Bluffs, the eye is dazzled in the sun-light reflected from heaps of rounded quartz, some masses of which will measure several cubic yards. The smaller boulders are in general washed away; but I looked with surprise at one portion of an unworked bank at Michigan Bluffs, observing that it was composed almost entirely of quartz fragments, from pebble size upward, all having the usual rounded or ovoid form.

There will be little doubt, I think, that we have here the origin of the gold which occurs so plentifully in connection with the gravel of this section of country, but the question remains as to how the attrition has been performed which liberates it.

What tremendous powers have, in the first place, dislocated from their original casings the gold-bearing quartz ledges, and in the next, ground, to so perfect a smoothness and rotundity, the hardest specimens of white, blue, and rose-colored quartz fragments?

Mere fluvial action, however violent, will account not at all for the first con-

dition, even if it does for the second. Granite, in the Placer county gravel beds, occurs only in boulders associated with the quartz, and that sparingly, the bed rock being universally a slate; and in this respect, the difference between the placer diggings of Idaho Territory and those of central California, is very remarkable. In Idaho, the bed rock is everywhere granite; and the ledges which have supplied the gold are often distinctly traceable, good diggings being found below them, as in Granite Gulch, near Placerville, and none at all above.

To what, then, shall we refer the disruption, in California, of that primitive relationship of rocks, which we find still remaining in Idaho?

Perhaps volcanic action may account for it; and in connection with this view I wish to present to the notice of the Society a specimen of the peculiar substance called cement. This substance occurs very abundantly in distinct, and sometimes alternate, stratification with the gravel, in most of the Placer county mines; in fact, in all of them which I had opportunity of visiting. It does not, so far as I could see, mix with the gravel, but is often of a depth and hardness as seriously to embarrass the operations of the miner. Being entirely barren, it has sometimes to be blasted with powder or nitro-glycerine, before the hydraulic stream will act upon it, and then adds greatly to the cost of hydraulic operations.

As will be observed, it is a grayish white, and so homogeneous, apparently, in its nature, that the miners generally, though very ignorantly, call it pipe-clay. Although this whitish color is the usual tint, I have observed it in some situations to be of various shades of brown.

Now, is this substance a volcanic ash, and if not, what is it?

I think the answer to this question carries with it a solution of much of the difficulty in accounting for the condition of things in central California. Admitting that this cement is a true product of volcanic eruption, the large extent of surface covered by it and its frequent great depth, would lead us to infer an enormous amount of volcanic activity, perhaps in connection with the elevation of the neighboring peaks of the Sierra Nevada range.

Mr. Hanks kindly afforded me a microscopic examination of the present specimen, and it appears to resolve itself into the three elements of granite—quartz, mica and feldspar. This is not an unusual condition of volcanic ash, and if my impression is correct, it is, with the addition of sulphur, exactly the analysis of the ash ejected in the recent eruption of Vesuvius.

But even considering it as settled that cement is a volcanic ash, solidified by time and pressure, we have still two things to account for; one, the almost total disappearance of the granite, the other the levigation of the quartz.

After due consideration of the effects of prolonged action of the surf on both salt and fresh water beaches, in the production of such gravel and boulders as we see in Placer county—as I doubt whether the ancient river system can be taken into the question, or is so clearly traceable—there is one other mode of explanation of most, if not all the phenomena alluded to, which I think deserves attention. I refer to the grinding and comminuting power of glacial action.

Of all the forces of nature which effect transformation of the surface of the

earth, the progress of glaciers is among the most potent. Every year brings new proofs of the extent and importance of the changes effected by glacial movement; and perhaps investigation may show that there was a time in which, from the western slopes of the Sierra Nevada range proceeded icy masses, of a magnitude and weight sufficient to have crushed out and destroyed the original relationships of rock over which they traveled; and to have had much to do with, if they were not the principal cause of, the disrupted and almost chaotic state of the earth's surface in Placer county.

Dr. Kellogg called the attention of the Academy to the following new species of plants, specimens of which he exhibited.

Descriptions of new Plants from the Pacific States.

BY A. KELLOGG, M. D.

Lupinus palustris, Kellogg.

Stem stout, annual, fistulous (cotyledons thick, large, connate and persistent), striate by the decurrent nerves from the base of the leaves, 3 to 8 inches, or more, in height, often subsequently branching 3 to 6 inches more beyond the main axis and its elongated terminal spike; long, soft, silky, pubescent, or subglabrous, with barely very minute villi; peduncles stout, as long, or often longer than the leaves (3 to 5 inches), rachis somewhat longer still; leaves loosely clustered toward the top; petioles long, rather robust, base expanded and strongly clasping the stem, the 3 prominent nerves decurrent, stipules subulate, hirsute, ¼ to ½ an inch long, leaflets 6 to 10, obovate-oblong, obtuse, mucronate, retuse, narrowed at the base, glabrous above, subpubescent beneath, ¼ to ½ the length of the petiole; spike 6 to 12 inches; flowers large, violet-blue, pinkish, or verging to white, pedicellate, subverticellate or verticellate, somewhat scarious bracts persistent, subulate, the setaceous acumination extending to about half the length of the lower lip, subscarious calyx bracteolate or ebracteolate hirsute, about half the length of the somewhat ciliated keel, slightly saccate; upper lip 2-toothed, lower herbaceous lip mostly 2-toothed, seldom sub-entire; wings very broad, obtuse, with a rhomboidal outline; petals equal. Legumes very appressed, (silvery?) hirsute, compressed, an inch or more in length, about 8-seeded.

Collected by Kellogg and Bloomer on the San Joaquin River, April 7th, 1869. Differs from *Menziesii* — a 2-seeded species, — whereas this has 8 or more; also one var. (deep purple-blue flower), has very distinct bracteoles. No variety of *L. polyphyllus* — with 13 to 15 leaflets, short, caducous bracts and ebracteolate calyx—3 to 5-feet stem, etc., and if we mistake not, perennial root, will allow it to be placed under that name. *L. latifolius* also has a perennial root, smooth stem, bracts longer than the flowers, ebracteolate calyx, entire lips and glabrous keel, etc.

Lupinus Menziesii, var. *aurea*, Kellogg.

Collected by Kellogg and Samuel Brannan, Jr., in Deer Valley, near Anti-

och, San Joaquin River, April 22d, 1869; chiefly differing from the accepted description of the species—if we include also *L. densiflorus*—in the 2-toothed lower lip, relative length of leaves, and the entire scarious tube of the calyx, etc.

Stem fistulous, branching from near the axil summit, leaflets about 10, one-third the length of the petiole, glabrous above, pubescent beneath, stipules and bracts scarious, setaceously long acuminate, persistent; calyx-tube scarious, upper-lip 2-toothed, deflexed, somewhat saccate; vexillum short, rounded outline, pubescent on the back at the base, and along the claw above. Legumes hirsute, minute, 2-seeded.

Calystegia villosa, Kellogg.

Bracted Bindweed or Cloak-cup Morning Glory.

Root perennial, horizontal, rhizomoid, and fibrously sub-rooting, at intervals from the main crown; stem oblique or erect, or occasionally twining from right to left, hoary, velvety-villous throughout, 4 inches to 2 feet high; leaves mostly reniform-cordate, hastate-saggittate, (circumscription somewhat triangular,) open sinus, very deep, lobes broad, subrhombic, angular lobes acute, pointed apex abruptly acute, mucronate; petioles mostly about equalling the length and breadth of the lamina, about 3-nerved, the lateral nerves often forked above the sinus (or pseudo-5-nerved): peduncles assurgent or erect, as long or longer than the petioles, terete, fistulous; bracts leafy, subcordate, (rarely subacute) acute or acuminate; or ovate, acute or acuminate, 3 to 5-nerved, sub-entire (or rarely distinctly dentate), loosely appressed, covering the calyx, ⅓ to ⅔ the length of the flower, internal or proper calyx sepals very unequal, outer ovate-oblong, acuminate, foliaceous and villous, successively reduced, the 2 or 3 inner scarious, glabrous, ciliate, nerved and narrowed to linear, lanceolate, acuminate, tips only villous.

Style and stamens equal, hirsute at the base. Stigmas 2, linear, oblong; filaments of stamens glabrous, anthers oblong, creamy-white, introrse fixed by the base, etc.

Ovary villous (in young state), ovoid, acute. Flowers white, with a tinge of cream.

Abundant on hillsides at Cisco, C. P. R. R., 6,000 feet high on Sierra Nevada mountains; found by Kellogg and Brannan, June, 1870.

This plant most nearly resembles the Span-long Bind-weed, *Calystegia spithamæa*, but as we see that in the vicinity of San Francisco, it has not the leaf, bracts, calyx, or peduncles; here they are in pairs, and the whole plant more naked. This also includes, probably, *C. stans*, *C. acaulis* and *C. tomentosa*; it cannot be *C. paradoxa*, for that has linear bracts, etc.

Helianthus giganteus, var. *insulus*, Kellogg.

Found on a recent visit to an island of the San Joaquin River, on Mr. Kimball's farm, Webb's Landing. Fall of 1872.

Perennial root; stem 6 to 10 feet high, loosely paniculate; branches purple, smooth, peduncles scabrous; flowers 2 to 3 inches in expansion, (yellow through-

out,) rays an inch or more in length, 12 to 20; leaves opposite below, alternate above, lanceolate, acuminate, entire or sub-entire, attenuate below, triplinerved and ciliate at the base, scabrous on both sides, subpetiolate. Involucral scales linear-sublanceolate, attenuate, about twice the length of the disk, squarrose spreading, scabrous, ciliate at the base, 3-nerved; chaff shorter than the expanded florets, linear-oblong, carinate, acute, commonly a short tooth on each side near the apex, striate, pubescent at the summit and on the back, chiefly above; achenia of the disk with 3 to 4 (rarely 5), long, carinate-subulate, chaffy awns, laciniately fringed or finely toothed; ray achenia, with 1–2 well developed awns, the remainder rudimentary. Lobes of the disk florets scabrously ciliate at the base; on the back somewhat lanose and appressed-hirsute, chiefly canescent at the junction with the tube. Receptacle convex, somewhat distinctly alveolate.

There are strong grounds for considering this an entirely new species, rather than variety, but owing to the lateness of the season we prefer more ample investigations; for the present it may rest here. The parallels of other species will be given hereafter.

Chionanthus fraxinifolius, Kellogg.

A shrub 25 to 30 feet high, branches quadrangular, angles winged. Leaves oddly pinnate, leaflets opposite, in about 3 or 4 pairs, with a terminal odd one, (5 to 6 inches in length,) pinnules petiolate, about ⅓ the blade, which is ovate or oval, subacute, serrate, base entire and abruptly short-cuneate, often somewhat oblique, the terminal leaflet obovate, obtuse, cuneate; leaf glabrous throughout, leaves opposite. Panicles drooping, peduncle laterally sub-compressed, numerously subdivided irregularly in alternate, opposite, verticillate, and fasiculate, or in ultimate pedicels of threes, etc., the rather minute oblong scarious bracteoles at the base of the slender pedicels mostly caducous; glabrous throughout; monosepalous calyx cup-shaped, sub-scarious, small, persistent, border-toothed, teeth 4 to 6 or more, obscurely-triangular acute or mucronate elevations, or notched and secondary pseudo-teeth; stamens one to two, filaments short, opposite, alternating the petals, scarcely half the length of the anthers, or longer than the calyx (1-line), when dry, apparently twisted, cohering with the petals at the somewhat expanded base into a partial or entire short ring or tube, anthers linear-oblong, subcordate base, introrse, cells laterally dehiscent, fixed by the base; petals oblong-oval, obtuse, claw ¼ the blade, or if coalescent oblong or obovate, (¼ to ½ an inch in length,) distinct or slightly cohering into a partial tube (in one instance only), and then deciduous with the stamens; style clavate, notched or slightly emarginate, stigma about ⅓ longer than the filament, shorter than the anther or anthers; drupe fleshy, oval or sub-globular—ripe fruit not seen.

Collected by Dr. William O. Ayres, at Borax Lake, about four years ago. The description is made from very imperfect fragments — a full and good set of specimens much desired. Although, in some points, this shrub fails to agree

with the generic description, as it now stands, it is manifest that a slight revision only is required to welcome this remarkable discovery.

If, from generic differences above indicated, and more ample means of investigation, this should be deemed of intermediate generic position between *Chionanthus* and *Forsythia*, it should be entitled *Ayrseia fraxinifolia*.

Dr. Ayres observes: "When young, a graceful and beautiful tree or shrub, as it grows older, it loses its beauty very much—becomes straggling and irregular, never showing a straight symmetrical trunk; 25 to 30 feet high."

Regular Meeting, February 17th, 1873.

President in the Chair.

Forty-three members present.

Gregory P. Hart was elected a resident member, and George C. Hickox and James Lick, life members.

Donations to the Museum: Specimen of Hornblende containing 20 per cent. of magnetic iron from the Chilcat River, by George Davidson. Fossil bones of a species of Rodent found in the drift of the Eureka Consolidated Mining Company, Nevada, at a depth of 247 feet below the surface, near the top of the ore, and immediately under the hanging rock, which is a limestone. Also, a specimen of Silver ore from same mine, by G. T. Lawton. Sections of a pile taken from Greenwich Dock, showing the ravages of a marine crustacean (*Limnoria ?*) which has recently appeared in the harbor of San Francisco, by T. J. Arnold. Head and antlers of the black tail deer, from Utah, by C. B. Turrill. Fossil from the Arizona desert, also specimens of an Isopod crustacean, parasitic on the tomcod and other fishes in the Bay, by J. P. Dameron.

Mr. John Hewston, Jr., in announcing the gift of a valuable piece of land on Market street, read the following deed from our fellow member Mr. James Lick:

This Indenture, made and entered into this fifteenth day of February, A.D. one thousand eight hundred and seventy-three, by and between James Lick of the county of Santa Clara, State of California, party of the first part, and

the CALIFORNIA ACADEMY OF SCIENCES, a corporation duly incorporated and acting under the laws of the State of California, having its principal place of business in the city and county of San Francisco, State aforesaid, party of the second part, WITNESSETH: That the said party of the first part, in consideration of the desire he has to promote the diffusion of science, and the prosperity and perpetuity of said party of the second part, hath given, granted and confirmed, and by these presents doth give, grant and confirm unto the said party of the second part, and its successors, all that certain parcel of land situate in said city and county of San Francisco, State aforesaid, circumscribed by a line commencing at a point on the south-easterly line of Market Street, distant one-hundred and ninety-five feet south-westward from the southwesterly corner of Market and Fourth Streets, and running thence south-eastwardly and parallel with said Fourth Street, one hundred and ninety-five feet; thence south-westwardly, at an angle of forty-five degrees, to a point two hundred and seventy-five feet from said south-easterly line of Market Street, which last-mentioned point constitutes the south-westerly corner of the hundred-vara lot hereinafter mentioned; thence north-westerly, and parallel with said Fourth Street, two hundred and seventy-five feet to said south-easterly line of Market Street; thence north-eastwardly and along said last mentioned line of Market Street, eighty feet to the point of commencement; said parcel of land being a portion of that certain lot of land, laid down and commonly known upon the official map of said city of San Francisco, as Hundred-vara Lot No. One hundred and twenty-six: reserving and excepting, out of and from said granted premises, all buildings, tenements and improvements of any of the tenants of said party of the first part, that now are, or may be situate thereon at the time when said party of the second part shall be entitled to the possession of said premises; and excepting and reserving out of and from this grant and conveyance, the right to possess, use and occupy said premises for the period of two years from the date hereof, unless sooner determined, as hereinafter provided; which right of possession, as aforesaid, said party of the first part hereby reserves unto himself, his heirs and assigns: TO HAVE AND TO HOLD, all and singular the premises hereby given and granted unto said party of the second part and its successors, upon the following terms and conditions, nevertheless; which terms and conditions shall be binding and obligatory upon said party of the second part and its successors, that is to say:

FIRST — That said premises shall be used and devoted solely and exclusively for scientific purposes and for none other, and shall never be used for political or religious purposes.

SECOND — That said premises shall never be incumbered by said party of the second part, or its successors; and shall never be allowed or suffered by said party of the second part, or its successors, to be sold for any taxes, assessments, or other charges, levied or placed, or suffered to be levied or placed thereon.

THIRD — That said premises shall never be alienated by said party of the second part, during the life of any of the existing members of said California Academy of Sciences.

FOURTH — That said party of the second part shall never lease said premises or any part thereof, or any edifice or any part of any edifice, erected or to be erected thereon, and said party of the second part shall never permit or suffer any person to possess, use or occupy the whole or any part of said premises, or any edifice or any part of any edifice, erected or to be erected thereon, save for its own proper purposes.

FIFTH — That said party of the second part shall erect, and forever maintain upon said premises, an edifice of the description hereinafter mentioned; which shall cover all of said premises except that portion thereof hereinafter described, and devoted to the purposes of furnishing light and ventilation to said edifice.

SIXTH — That said party of the second part shall erect upon said premises, except that portion thereof hereinafter described, a substantial and elegant brick edifice, three stories in height, with a substantial granite front, faced with appropriate scientific emblems. The structure and design of the edifice shall be classic, and such as will readily distinguish it from buildings used for business or commercial purposes. The style of architecture of said edifice shall be chaste and appropriate, and the same style and order of architecture shall be preserved throughout, in its purity.

SEVENTH — In order to render this gift and conveyance effectual, said party of the second part must, within two years from the date hereof, secure the necessary funds to commence and to complete said edifice; and must commence the erection of this edifice and complete the same with all reasonable dispatch; and as soon as said party of the second part shall secure the necessary amount of funds, at any time within said period of two years, upon thirty days' written notice of that fact to said party of the first part, or his heirs or devisees, the said party of the second part shall be entitled to the possession of said premises, and the right of possession of said premises hereby reserved to said party of the first part shall thereupon cease and determine. The said party of the first part hereby reserves to himself and his heirs and assigns, the right to use, possess and occupy said premises, up to and until said party of the second part shall have secured the aforesaid necessary amount of funds, and until notified of that fact as aforesaid; but said funds must be secured and the erection of said edifice be commenced, within a period of time not to exceed two years, as aforesaid.

At least one apartment of said edifice shall be constructed suitably for, and devoted to the purposes of a Library; another apartment thereof shall be constructed suitably for, and devoted to the purposes of a Museum; and a third apartment thereof shall be suitably constructed for, and devoted to the purposes of a Hall for Lectures.

EIGHTH — That the following portion of said premises shall never be built upon but shall forever be kept free and open, for the purpose of affording light and ventilation to said edifice; that is to say, that part of said premises circumscribed by a line commencing at the south-westerly corner of said premises, running thence north-westwardly and parallel with Fourth Street, fifty feet; thence north-eastwardly and parallel with said Market Street, fifty feet; thence running at an angle of forty-five degrees to the point of commencement.

Should said party of the second part, or its successors, violate or fail to fulfill any of the foregoing terms and conditions, then and immediately thereupon, the estate, and all interest given and conveyed, shall cease and determine; and the same, to wit: All interest and estate hereby given and conveyed, shall immediately revert to, and revest in said party of the first part, his heirs and assigns, without any previous entry to assert such failure or breach.

In Witness Whereof, said party of the first part hereunto sets his hand and seal, the day and year first herein above written.

JAMES LICK.

Signed, sealed and delivered in the presence of Samuel Hermann.

State of California,
City and County of San Francisco, } ss.

On this fifteenth day of February, in the year one thousand eight hundred and seventy-three, before me, Samuel Hermann, a Notary Public in and for the said city and county, duly commissioned and sworn, personally appeared James Lick, known to me to be the person whose name is subscribed to the within and foregoing document; and he, the said James Lick, acknowledged to me that he executed the same.

In Witness Whereof, I have hereunto set my hand and affixed my official seal, the day and year in this certificate first above written.

[seal.] Samuel Hermann.

Notary Public.

Recorded in the office of the County Recorder of the city and county of San Francisco, February 20th, A. D. 1873, at 15 min. past 3 P. M., in Liber 696 of Deeds, page 364.

A. R. Hynes,

County Recorder.

The President remarked that he felt incompetent at the time to express the sense of the Academy in fitting terms. The trustees, in considering the project of securing accommodations for the Academy, had never thought of exceeding an expenditure of $25,000. But this site alone, as he had been assured by competent judges, exceeded in value $100,000.

The Probable Periodicity of Rainfall.

BY GEORGE DAVIDSON.

Many attempts have been recently made to establish a periodicity of rainfall commensurate with the eleven-year period of the solar spots. In limited cases the law has appeared to prevail, but in cases as apparently reliable, the results have been adverse. In an extended series of observations of the rainfall in Eng-

land, stretching through 150 years (British Association Report for 1866) no such maxima and minima could be deduced; and in a series of observations over various parts of the globe, gathered by G. J. Symons, in number 165 of *Nature*, the same want of law is manifest; in fact, where maxima of rainfall should be expected, we find minima, and *vice versa*. These tables are, however, too limited to deduce a general law therefrom. The materials are at hand for a much more comprehensive treatment of the problem.

But if there is a law in such cases isochronous with the exhibition of the sun spots, it must be qualified by other variable functions than rainfall; such as the temperature and pressure of the atmosphere, and the amount of aqueous vapor in the atmosphere, the direction and force of the winds, and the climatology, not only of the adjacent ocean, but of the sources of the great currents that cross the ocean. For example: if the rainfall of the western coast of Europe is assumed dependent upon the same causes which occasion the solar spots, the epochs of the maxima and minima rainfall would not coincide with those of the solar spots, because the precipitation of rain and the temperature of the seaboards of Ireland, Scotland, Norway, Iceland, Spitzenbergen, etc., depend upon the temperature of the Gulf Stream bathing those shores; and the waters of the Gulf of Mexico heated to a maximum at a given epoch would not reach the coast of Norway for possibly a year. The same is true of this coast; the heated waters of the great Japan stream, at their point of departure near the island of Formosa, do not reach this coast for more than a year. Thus whilst these superheated waters are delayed one year in reaching their destinations, the climatic conditions of the coasts of Norway and of California, supposed to be governed by a regular law, have been changed, and the problem is complicated and masked by these changes in the nearer effects of the climate of the adjacent continents; and in the European case, of the Polar Basin.

If there is a law of the rainfall, there will naturally be a similar law for the temperature and pressure of the air, and for the winds; but it must be complicated and masked by the influence of great ocean currents, so that the problem, instead of being simple as it first appears, is in reality very intricate.

An attempt has been made to give an eleven-year period to the cyclones in connection with the rainfall, but evidently upon insufficient data, for Mr. Meldrum only claims that a supposed periodicity has been made out. Lockyer (*Nature*, No, 163) in discussing Mr. Meldrum's records and others at Madras and the Cape of Good Hope, sees in them indications of a periodicity, but his discussion is merely tentative from insufficient materials, and is not satisfactory.

The same eleven-year period has been assigned to the seasons of great freshets in California; but we need, what we cannot obtain, absolute observations over extended areas, and not mere reports, to aid in its establishment. The statement was common in the West that the greatest freshets occur on the great rivers of the Western States about every ten years.

I have had placed in graphical order the rainfall at San Francisco for twenty-three years, from Mr. Thomas Tennent's observations, and exhibit it to show

that we cannot, from it alone, predicate any periodicity. Even the well mark short period of comparatively little rainfall and of clear weather during each our wet seasons, is masked in the averages of monthly rainfall in these years its not occurring at any well defined epoch. But its existence is well mark and established in the illustration of the monthly rainfall from 1849 to ti present.

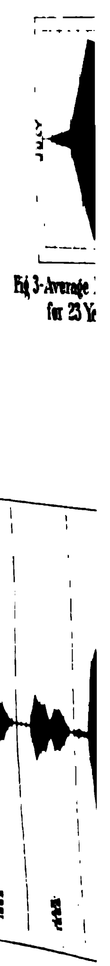
[In the graphical illustration of the rainfall at San Francisco, the vertic black lines shown in fig. 1 indicate the inches of rainfall each year. The ave age annual volume of rainfall throughout twenty-three years, for each mon from June to July is shown in fig. 2. The short dry period of each wet seaso is there shown to be marked. In fig. 3 the average monthly and annual volum of rainfall, for every month to the present year, is exhibited. This is on a sca of inches twice that of fig. 2. In this the break in the wet season of most o the years is plainly marked, but it does not occur with any regularity as t time.]

To arrive at a law of periodicity in atmospherical phenomena, will demand comprehensive scheme of observations over a large extent of the earth and ocean this scheme to involve all the conditions of atmospherical variations, and th local relations of each station to the whole, and be represented in graphical rather than in numerical order.

I believe in the law of periodicity of these phenomena, but it will be foun an intricate problem, and is doubtless involved with such conditions as the luna cycle of nineteen years, etc. As stated in my paper last year, upon "Suggestio of a Cosmical Cause for the great Climatic Changes upon the Earth," we must expect abnormal exhibitions of these phenomena from the irregular exhibition of the materials burning upon the surface of the sun; but in a prolonged series of spectroscopic observations of solar phenomena, and observations of physical phenomena on the earth, we will eventually arrive at the law of their recurrence.

Dr. George Hewston called the attention of the Academy to a new species of Crustacean which had recently been detected in the bay, and which was exceedingly destructive to wood-work, more particularly the piling of the wharves along the water front of the city: specimens were exhibited under the microscope, by Dr. Hewston, who referred them to what are popularly known as "gribbles," or "Limnoria"; and to which he attached provisionally the name of *Limnoria California*.

The following amendment to Sec. 2, Art. III of the Constitution having been presented to the Trustees as required by Article VII, was submitted to the Academy and unanimously adopted:



V.

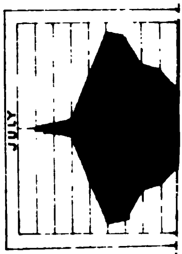
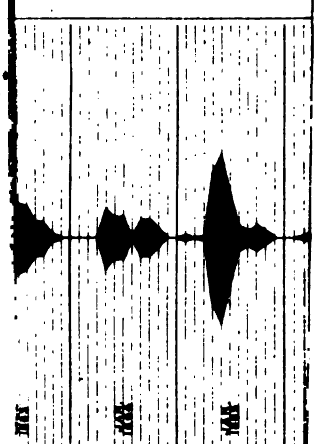


Fig 3-Average Monthl
for 23 Years 18



849-72.

"The Vice-President shall attend all meetings of the Trustees, and in case of the absence of the President shall preside at the same and be entitled to vote."

Notes on the Avi-fauna of the Aleutian Islands, from Unalashka eastward.*

BY W. H. DALL, U. S. COAST SURVEY.

The following notes were taken during the year, from October, 1871, to August, 1872, inclusive, while employed in a geographical reconnaissance among the Aleutian Islands, for the U. S. Coast Survey. The specimens have been deposited in the National Museum at Washington; and I am under obligations to Prof. S. F. Baird, of the Smithsonian Institution, for assistance in identifying the species. The nomenclature and arrangement adopted is that of the "Birds of North America," by Baird, Cassin and Lawrence, and the numbers affixed to the species are those of the catalogue of species which accompanies that work. The facts noted are an additional confirmation of the peculiarities of distribution noted by me in previous publications on the fauna and birds of Alaska; and the region visited is of peculiar interest, as being the portion of the West Coast where the Arctic Canadian fauna of the region north of the Alaskan Range, and the characteristic West Coast fauna which prevails south of that range, come together, and are to a certain extent intermingled. Among other things, I would call attention to the fact that the color of the eye in the same species of bird is not invariably the same, even in adults of the same sex, a point which has doubtless been previously noticed by ornithologists, and which my observations on several species confirm. I would remark that the region visited by my party was comprised between the Shumagins on the east and Unalashka on the west, among the islands.

Tinnunculus sparverius, Lin. (13.)

A specimen of this species was killed in Unalashka, in the fall of 1871, but was unfortunately destroyed before the skin could be preserved. It may be considered rare, as it was not noticed on any other occasion.

Aquila canadensis, Lin. (39.)

Obtained at Unga Island, in the spring of 1872, and very common throughout the islands, as far west as Unalashka. The remarks under the head of the next species will apply to this one also. The eye was orange-brown. A resident.

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* Printed in advance, February 8th, 1873.

Halaetus leucocephalus, Sav. (43.)

This species is exceedingly abundant throughout the islands, where it is found during the entire year. It builds on rocky cliffs, and is exceedingly miscellaneous in its diet, subsisting in winter principally upon ducks and ptarmigan, and in summer upon the salmon which are found around the mouths of streams, in such great abundance that the eagles have little or no difficulty in obtaining a sufficiency of food. At one time, near a salmon run in Sanborn Harbor, Nagai, I counted seventeen eagles within a hundred yards. The eyes and feet are pale yellow, and there is a considerable variation in their plumage, some individuals being much darker than others. The young are hardly able to fly before the end of the season, though hatched early in the spring. The nest is usually composed of small sticks, with a lining of dry grass, and the same nest appears to be occupied for several successive seasons. Many of these eagles were found dead during the winter, without any signs of injury or wound, too fat to have starved to death, and with no weather cold enough to have affected them injuriously. I have not been able to suggest any adequate explanation of the mystery.

Brachyotus Cassini, Brewer. (52.)

This species is not uncommon, and is a resident in Unalashka, and probably in the other islands. In those obtained, the iris was bright yellow. It builds in holes in the ground, usually on the side of a steep bank; the hole is horizontal, and the inner end usually a little higher than the aperture; lined with dry grass and feathers. Those which I examined did not exceed two feet in depth. There are no trees in Unalashka, and the species was often observed sitting on the ground near its burrow, and not unfrequently in the day-time.

Nyctea nivea, Gray. (61.)

I did not see this species living, but there were several skins or portions of skins in the village at Unalashka, used as ornaments. Mr. B. Bendel had one in his house, which he had killed himself. It is reported to be a resident.

Cinclus mexicanus, Bon. (164.)

This bird is not uncommon near the small streams in the mountains of Unalashka. It is a resident. The color of the feet varies from flesh to slate color; the eye in fresh specimens appears to be of a light brown, but soon turns black after death. Its habits here are the same as on the Yukon, as far as I was able to observe them.

Hirundo unalashkensis? Gmelin.

In June, 1872, a swallow was occasionally seen at Iliuliuk, Unalashka, which was supposed at the time to be *bicolor*, but may have been the above species. A summer visitor, and said to build.

Troglodytes hyemalis, var. *alascensis*, Baird. (273.)

A resident. Abundant on the rocky cliffs of Amaknak Island, Unalashka,

where it is quite familiar and bold. It builds in the crevices of the rocks, but I was not able to find the nest. It has a cheerful and melodious note, and is, to some extent, gregarious; three or four being usually seen together. It was not seen in the Shumagins, though it may occur there. Eye black.

Leucosticte griseinucha, Bon. (323.)

This is one of the most abundant small birds of the islands, and is especially common in Unalashka, where it is a resident. On the 24th of May we found a nest, situated in a crevice of a rocky bank on the shore of Captain's Harbor, Unalashka. It was of grass, very neatly sewed together, and lined with fine grass and a few feathers. It contained five white eggs in a fresh condition, and was about twelve feet above the beach. The bird's eye is black. It was most common on the grassy banks and rocky bluffs near the shore. I do not remember ever having seen one on the higher hills or mountains. It is usually found singly, or in pairs.

Plectrophanes nivalis, Lin. (325.)

This is also a resident of Unalashka, and not uncommon, though shy and usually confined to the mountains. It is only seen near the shore when the heaviest snows of winter have entirely covered up the seeds and berries, and it is forced to find a subsistence on the beaches. It goes in large flocks, and builds on the mountains, though I did not obtain a nest. Eye black.

Passerculus sandwichensis, Baird. (333.)

When about five hundred and fifty miles from land (the Shumagins being nearest) in latitude 47° N., and longitude 152° 03′ W., one of these birds flew aboard, and being secured, lived several days in an extemporized cage. This was on the 13th of September, 1871. The wind was moderate, from the N.W., but had been blowing harder. The eye was black and the feet flesh color. It is a summer resident throughout the islands east of Unalashka, and was not uncommon there and in the Shumagins.

Zonotrichia coronata, Baird. (347.)

This bird was not uncommon in the Shumagins in summer, where it builds; but I have not heard of it at Unalashka. The eye is dark brown. Our specimens were obtained on Popoff Island, June 22, 1872.

Melospiza insignis, Baird.

This bird appears to be a resident of Unalashka, and is common at the Shumagins. It is comparatively common at the former locality, and appears to frequent the low flats and beaches along shore, exclusively. I have never observed it far inland or at any great altitude. Eye black.

Corvus carnivorus, Bartram. (423.)

Abundant around all the villages, but seldom seen far away from the habita-

tions of man. It is half domesticated in its habits, and builds in April, on the rocky cliffs.

Pica hudsonica, Bon. (432.)

Abundant in the Shumagins, building in the alder bushes, and going as far west as they do, namely, to False or Isanotsky Pass, at the termination of Aliaska Peninsula. It is not found in Unalashka, nor on the northern shore of the peninsula. It appears to be a resident, but may migrate in winter.

Lagopus albus, Aud. (467.)

A resident from the Shumagins to Unalashka, but more confined to the mountains, and except during incubation, much shyer than in the Yukon region. In Unalashka it generally retains a few brown feathers even in winter. The nest and eggs (9) were found at Popoff Island, Shumagins, June 20, 1872, the embryos being well developed. I made inquiries in regard to *L. rupestris*, but could get no information, and do not think that species is found in the islands.

Hæmatopus niger, Pallas. (513.)

This bird is a summer visitor to the islands, and was seen both in Unalashka and the Shumagins. The eggs, partly incubated, were obtained on Range Island, Popoff Strait, Shumagins, June 23, 1872. There were two in one nest and one in another, if nest it could be called, being simply a depression in the gravel of the beach without even a straw to soften its asperities. The birds are exceedingly wary, and kept entirely out of gunshot, but were fully recognized. They utter, when disturbed, a peculiar, low whistle; which, once heard, is likely to be remembered; and they have a habit of standing on the beach or rocks a little way apart, and whistling to one another; one calling and the other answering; and keeping it up for half an hour at a time. It is one of the most peculiar birds of the region in its motions, having a grave, solemn and stilted gait, and bobbing its head up and down with every step.

Tringa (Pelidna) maritima, Brunn. (528)

Iris black. A resident. Abundant along shore throughout the year, in the islands from Unalashka to the Shumagins. Nest and eggs not observed.

Tringa crassirostris, Temm.

Breeding abundantly at the Pribyloff Islands, though previously known only from Eastern China and Japan. (H. W. Elliott, coll.)

Actodromus minutilla, Coues. (532.)

Obtained at Popoff Island, June 20, 1872. Eye black. Rather abundant along the beaches.

Charadrius virginicus, Borck. (503.)

This species was obtained June 22, 1872, at Popoff Island, Shumagins, the only instance when it was observed. Iris black.

Limosa uropygialis, Gould.

This species was obtained—a single individual—on the Chica Rocks, Aku-

tan Pass, near Unalashka, June 2, 1872. It was not observed on any other occasion. Iris black.

Anser Gambelli, Hartl. (565.)

This species is reported as occurring incidentally in spring and fall on the islands near Unalashka, which lie on its way to and from its northern breeding grounds. We obtained no specimens.

Philacte canagica, Bann. (573.)

This species which has been reported from the Aleutian Islands, did not occur among our collections in the region visited. I was at some pains to make inquiries in regard to it, and it appeared to be unknown to the natives. Mr. B. Bendel, however, informs me that during some seasons it is very abundant on the Islands of Akhun and Unalashka, but not near the settlements.

Anas boschas, Lin. (576.)

This is one of the most abundant winter visitors among the ducks at Unalashka. It occurred in plenty as early as October 12th, 1871, and was to be found from that time until the succeeding month of April, when it migrates northward.

Nettion carolinensis, Baird. (579.)

Plenty in winter, and is said to breed occasionally in Unalashka; though the greater number of individuals migrate northward about May 1st.

Querquedula discors, Steph. (521.)

This species is doubtfully reported as occurring at Unalashka in winter. We saw nothing of it.

Mareca penelope, Bon. (586.)

Obtained at Unalashka, October 12th, 1871. Not uncommon among the ducks brought in by the native hunters of that locality. A winter visitor, migrating about May 1st.

Bucephala americana, Baird. (593.)

A winter visitor at Unalashka, migrating in the spring. Eye, pale yellow brown.

Histrionicus torquatus, Bon. (596.)

A winter visitor at Unalashka, and rather common. It remains later than most of the ducks; and some individuals may remain and breed. Also, not rare at the Shumagins in summer.

Harelda glacialis, Leach. (597.)

Eye pale brown. A resident, and quite common; exhibiting great variety in coloration of plumage, as also observed on the Yukon.

Polysticta Stelleri, Eyton. (598.)

This is one of the commonest, as it is the most beautiful, of the ducks of Unalashka. It is a resident there, and also at the Shumagins, where, however, it is much less frequently seen. Unalashka appears to be the metropolis of the species in Alaska. It is more or less gregarious in the winter season, and is to be found in small flocks, which are sometimes joined by individuals of *Somateria spectabilis*, but I have not noticed the *Polysticta* associating with any other species except the one mentioned. About the first of May, the pairing commences, and this duck is never seen with more than one companion during the breeding season. It also becomes very shy, and if the nest be visited by any one, it is forthwith abandoned—a habit I have not observed in any other duck. May 18, 1872, a nest was found on a flat portion of Amaknak Island, Unalashka. It was built between two tussocks of dry grass, and the depression was carefully lined with the same material. Above the nest the standing grass was pressed together so as to entirely conceal it, and it would have escaped notice had not the bird flown out from under our feet. The nest contained one egg, of a pale, olivaceous cast. There was no down or feathers, though these might have been added later in the season, had the nest been undisturbed.

The following variations in the color of the eye were noticed. Nov. 21, dark brown; Dec. 18, pale-brown; May 18, red-brown. The female has a very modest, brown plumage, not as much speckled as the females of the other eiders, and a bright blue spectrum on the wing. The bird was also observed in the Shumagins in March, and in the summer months.

Lampronetta Fischeri, Brandt. (599.)

This species was not killed at Unalashka, though it was observed on several occasions and reported by the natives, who distinguish perfectly the different species of eiders. It was quite rare and very shy, and but one or two individuals were observed at a time. It is a winter visitor, migrating early in May to the breeding grounds on Norton Sound.

Oidemia americana, Swains. (604.)

Eye black. Not uncommon in winter, and migrating with the other ducks in the spring. Noticed at Unalashka and the Shumagins.

Melanetta velvetina, Baird. (601.)

Iris white. Killed Oct. 27th, 1871, at Unalashka, and noticed at intervals there during the winter. It was not seen at the Shumagins, though it may occur there. A winter visitor.

Somateria spectabilis, Leach. (608)

Eye varying from pale clay brown to light warm brown. Not uncommon among the winter ducks at Unalashka, but not observed in the Shumagins.

Mergus americanus, Cassin. (611.)

Several specimens were killed, Dec. 20, at Unalashka, in the outer bay, after a

norther. It does not come into the harbor, and cannot be considered as more than an accidental visitor, though reported to be common in winter near the Pribyloff Islands; not observed at the Shumagins. Eye dark. The specimens were so loaded with fat that only the heads could be preserved for identification.

Graculus violaceus, Gray. (627.)

Eye black. Common on the rocks in the outer bay at Unalashka, but seldom approaching the harbor. Gills, light flesh color below, passing into ashy gray above. This species is found in large flocks, and is very inquisitive, flying round and round about the boat when employed in sounding, uttering a shrill cry at intervals. Seen also at the Shumagins, abundantly. A resident.

Diomedea nigripes, Aud. (633*a*.)

Full notes were given on this characteristic North Pacific species, in a paper on the birds of Alaska, published by Dr. Bannister and myself, some time since. It generally joins the vessel within one hundred miles of San Francisco, and on this voyage, as on several others, it left us in Lat. 53° N. Observing its flight, I noticed that its ordinary method of sustentation when there is a breeze, consists in rising against the wind and falling with it; this being sometimes kept up for hours with hardly a stroke of the wings. It rises only against the wind, except in rare cases, when its descending momentum is sufficient to raise it slightly for a short distance, or when the reflex eddy from a high surge is strong enough to give it a slight lift. It uses its strong webbed feet to some extent in balancing itself when turning with the wind; also by extending them downward at a right angle with the body, to check its course, especially when alighting on the water. Generally, when flying, they are stretched out behind with the webs extended, and assist the bird materially in guiding itself, the tail being shorter than the extended feet. It rises by extending its wings and running against the wind over the water, until it is sufficiently raised above the water to use its wings without wetting them. Their eyesight is exceedingly acute; they can distinguish a discolored spot a yard across, in the water, from a distance of at least five miles, and even much further than our unaided eyes can see the bird itself. Its flight in calm weather consists of a series of five or six short, sharp strokes, at intervals of a second or more apart, followed by a short period of comparative quiet. They appear to subsist mainly on a pelagic crab (*Pinnotheres sp.*) and the refuse from vessels. They usually fly in flocks of six or eight, but often smaller, and on one occasion a solitary individual followed the vessel for hundreds of miles without a companion.

Another species, probably a *Diomedea*, larger than the *nigripes*, and with a large amount of white upon the plumage, spotted and streaked with brown, was observed on several occasions cast up dead and decomposed on the beaches of the island, but no fresh specimens were obtained.

Thalassidroma furcata, Gould. (640.)

This bird, though not observed anywhere at sea, was found on the Chica Rocks in the Akutan Pass near Unalashka, breeding, June 2d, 1872. The eye

is black. The nests were on the edge of a steep bank, near the shore, and ten or twelve feet above it. The nest was situated in a hole or excavation, extending obliquely downward and backward from the face of the bank, and about a foot deep. It was composed only of a little dry grass or fine roots at the bottom. In two instances the parent bird was caught in the nest, alive. There was only one small white egg, perfectly fresh, though others might have been laid afterward had they remained undisturbed. The black *T. Leachii*, though often seen in the region south of Lat. 50° N., was not noticed by us in this region.

Stercorarius sp.

A species of *Stercorarius* was observed on one occasion in the month of May at Unalashka, but specimens were not obtained, nor did the natives appear to be familiar with the bird, which was probably an accidental visitor.

Larus glaucescens, Licht. (657.)

This gull is a resident of the islands wherever I have been, and is by far the most abundant and prevalent species, others being only occasionally observed. The habit of this and other species in breeding on isolated rocks and small islands, is accounted for by the immunity thus gained from the ravages of foxes on the eggs and young brood. On the 2d of June, 1872, many eggs in a pretty fresh condition were obtained on the Chica Rocks and islets in the Akutan Pass. The eggs were very abundant, more than three being rarely found together, and were laid on almost any little depression of the ground, with little or no attempt at a lining. About the 18th of July, in the Shumagins, at Coal Harbor, on a peculiar high, round island, abundance of eggs were found, but most of them pretty well incubated. In this case, the island being covered with tall, rank grass, the nests were almost concealed; and, either from the dead grass naturally occurring in the depressions, or otherwise, all of them had more or less dry grass in and about them. The gulls built solely on the top of the highest part of the island, in the grass, and never on the lower portion, near the shore, nor on the shelves of the rocky and precipitous sides. It is a resident throughout the year. The young, in down, were obtained July 16th, and the iris of these specimens, as well as the beak and feet, was nearly black. The iris of the adult bird is a clear gray, the bill chrome yellow with a red patch anteriorly, and the feet flesh color.

Rissa Kotzebui ?

This species frequents the region about the peninsula of Aliaska at all seasons, but seldom comes into the harbors except in storms. A pair came into Iliuliuk harbor, Unalashka, whenever in the winter a severe gale was blowing outside, but they were never seen at any other time. They are quite different in appearance from the next species, and from *R. brevirostris*, which is common in the Pribyloff Islands.

Rissa tridactyla, Bon. (672.)

Iris of adult dark gray, bill lemon yellow, feet black; edges of eyelids, corners

of mouth and fauces, scarlet. Young in down: feet lead-color, bill and eyes black. The nest, eggs and young in down were all obtained about July 11th, 1872, at Round Island, Coal Harbor, Unga Island, Shumagins. They were also common at Delaroff Harbor, Unga, and seen at Kadiak, but not at Unalashka, or to the west of Unimak Pass. On entering Coal Harbor, Unga, we were at once struck with a peculiar white line which wound around the precipitous cliffs of Round Island, and was seen to be caused by the presence of birds; and as soon as an opportunity was afforded, I took a boat and went to the locality to examine it. The nests, in their position, were unlike anything I had ever seen before. At first it appeared as if they were fastened to the perpendicular face of the rock, but on a close examination it appeared that two parallel strata of the metamorphic sandstone of the cliffs, being harder than the rest, had weathered out, standing out from the face of the cliff from one to four inches, more or less irregularly. The nests were built where these broken ledges afforded a partial support, though extending over more than half their width. The lines of nests exactly followed the winding projections of these ledges, everywhere, giving a very singular appearance to the cliff, especially when the white birds were sitting on them. The nests were built with dry grass, agglutinated together and to the rock in some unexplained manner; perhaps by a mucus secreted by the bird for the purpose. The nests had a very shallow depression at the top, in which lay two eggs. The whole establishment had an intolerable odor of guano, and the nests were very filthy. The birds hardly moved at our approach; only those within a few yards leaving their posts. I reached up and took down two nests, one containing two young birds, and the other empty. Wind coming up, we were obliged to pull away, and the bird, which came back, lighted on the rock where her nest and young had been, with evident astonishment at the mysterious disappearance. After flying about a little, she again settled on the spot, and suddenly making up her mind that foul play on the part of some other bird had taken place, she commenced a furious assault on her nearest neighbor. As we pulled away the little fellows began to be affected by the motion of the boat, and with the most ludicrous expression of nausea, imitating as closely as a bird could do the motions and expression of a sea-sick person, they very soon deposited their dinner on the edge of the nest. It was composed of small fishes or minnows, too much disorganized to be identified. Eggs, in a moderately fresh condition, were obtained about the same time, but most of them were far advanced toward hatching.

These birds are very curious, and scouts are always seen coming from a flock of them when a boat or other unusual object approaches. These scouts very soon return to the flock if not molested, and the whole flock then proceeds to investigate the phenomenon.

They have a shrill, harsh cry, as well as a low whistle; the former being the usual expression when they are disturbed or alarmed, and the other to their young, or in communicating with each other. They leave the harbors after the young are fully fledged, and are found off shore during the winter, except in heavy storms.

At Delaroff Harbor, the nests were also attached to the sides of the bare rocks and pinnacles of scoriaceous lava, near the entrance. The irregularities which assist in supporting the nest are not disposed regularly, as at Coal Harbor, and therefore the arrangement of the nests is less uniform. The slight ledges and projections being so small as to be invisible at a short distance, the nests appear to be fastened like swallow's nests, to the perpendicular faces of the rocks, and present a remarkable and peculiar appearance.

Sterna macrura, Naum. (690.)

This beautiful little tern is abundant in the Shumagins, in some localities, and especially on a small island in Popoff Strait, called by us Range Island. Here a large number of eggs, mostly incubated, were obtained in the months of June and July. We did not notice it in Unalashka, nor were we fortunate enough to obtain the interesting species described by Prof. Baird from Kadiak, *Sterna aleutica*.

Colymbus torquatus, Brünnich. (698.)

One specimen seen dead on the beach of Simeonoff Island, the most eastern of the Shumagins, Sept. 2, 1872.

Podiceps Cooperi, Bd.

Eye with a narrow, pale yellow iris. Obtained through Mr. Bendel, at Unalashka, Dec. 14, 1871. Not common, but said to be a resident.

Mormon cirrhata, Bon. (713.)

Seen abundantly in Unalashka on the outer rocks and cliffs (where it breeds in inaccessible situations), but never in the harbor. A resident. Not seen at the Shumagins.

Mormon corniculata, Naum. (713.)

Rare at Unalashka; very common in the Shumagins, where it appears to fill the place of the last mentioned species. A resident. It breeds in holes and crevices in the cliffs of Round Island, Coal Harbor, Unga; and the eggs were obtained there, and the parent bird, though caught on them, managed to escape; though well identified. The eggs were single, one in each nest, of a mottled, rusty color, with dark spots, though we had previously supposed them to be white.

Phaleris (*Thyleramphus*) *cristatella*, Bon. (719.)

Iris white. Abundant in very large flocks outside of Captain's Bay, Unalashka, but very rarely found inside the bay except during severe storms. A resident here and at the Shumagins.

Uria californica, Bryant.

With the preceding at Unalashka, but much less common. Eye black. The

remarks under *P. cristatella* will apply, except that this species was not noticed at the Shumagins.

Uria columba, Cas. (727.)

This bird was not observed at Unalashka, but was very common at the Shumagins. The eye of the adult is brown, that of the young in down, black. The feet of the young birds are also dark, and only assume the coral-red tint at maturity. It is an expert diver, very quick in its motions, and very hard to kill. The eggs were obtained June 24, 1872, at Popoff Island, Shumagins. They are two in number, and the nest is in a burrow or hole under rocks near the water's edge. Several were caught alive on their nests at Coal Harbor, Unga. The young in down were obtained there, July 16, 1872. All the eggs obtained were more or less developed. It is presumed to be a summer visitor.

Brachyrhamphus Wrangelli, Br. (733.)

Eye black. With *P. cristatella*, and quite common. Not recognized at the Shumagins, but probably abounds there.

Synthiliborhamphus antiquus, Brandt. (736.)

This species was obtained breeding, with the eggs, at the Chica Islets, Akutan Pass, near Unalashka, June 2d, 1872. They were caught sitting on their nests, which are in holes in the bank, similar to those of the petrels (*T. furcata*), previously described. There were two eggs in a nest, and in several cases the male bird was sitting on the eggs. Not recognized elsewhere, though it may be abundant.

Museum students can hardly realize the difficulty which lies in the way of obtaining the eggs, and even the birds of this family. The mormons build in most dangerous and usually inaccessible places, except when they happen to find an isolated rock or islet off the coast, which seems to promise protection, from its position. These islets are usually surrounded by breakers, and difficult of access except in unusually calm weather. There are few of the species which ever approach the more sheltered bays and harbors except when a severe gale drives them in, and then it is very difficult, even in the harbors, to go out shooting. For assistance in making my collections I am indebted to Mr. B. Bendel, Mr. B. G. MacIntyre, residents of Unalashka, and to Mr. M. W. Harrington, Capt. W. G. Hall, Mr. A. R. Hodgkins and the other members of the party, for assistance in obtaining specimens. As all my work was done in the very scanty leisure afforded by a surveying party actively engaged in the field—the hours devoted to the preparation of specimens being usually stolen from sleep—the circumstances will excuse any paucity in the results.

Regular Meeting, March 3d, 1873.

President in the Chair.

Thirty-eight members present.

John H. Carmany and Robert Robinson were elected resident members, and W. N. Lockington a corresponding member.

Dr. Kellogg submitted the following:

Descriptions of New Plants from the Pacific States.

BY A. KELLOGG, M. D.

Grindelia latifolia, Kellogg.

Stem stout, perennial branching, glabrous; radicle leaves spatulate, very large, 6 to 10 inches in length, blade 2½ to 3½ inches in breadth, decurrent into a very narrow (⅛ to ¼ of an inch) petiole, blade and petiole about equal, the latter successively shortening as the leaves ascend the stem, subcrenate serrate, obtuse on tips teeth with a callous mucro, margins scabrous, veins all decurrent nerved along the broadening midrib into the many-nerved winged petiole; cauline leaves oblong, often somewhat oblique, broader and cordate at the base, clasping often beyond the stem, many-nerved, and strongly decurrent-nerved along the stout midrib, obtuse, margins crenate, with mostly truncate teeth; 3 to 6 inches in length and 3 broad, becoming ovoid-cordate, or cordate, serrate, above; leaves of the branches also broad and obtuse, but successively diminished, serrate, clasping and more densely set, to the imbricated and clustered tips; heads large, sessile or sub-sessile; glandular and glutinous, involucre hid by a few broad, subacute, subtending, bractoid leaves; scales broadly linear acute, subulate pointed, but scarcely appendaged. Five-awned; often inserted below the crown.

The Academy is indebted to the U. S. Coast Survey for this new acquisition. Found by Mr. W. G. W. Harford, on the island of Santa Rosa. The plant is not liable to be mistaken for *inuloides*, as that is pubescent or hirsute-pubescent, and 1–3-awned, etc. *G. robusta* is more nearly allied; that has 2 (or more?) bristles — this, distinctly 5 — broadly leafy *below* the base, the subulate appendages obsolete—in both of those, conspicuously characteristic.

Lupinus sellulus, Kellogg.

Stem suffrutescent, much branched from the base, subdecumbent, the ascending stems 1 to 4 (rarely 6) inches in length, somewhat silvery-silky-pubescent throughout, chiefly below. Leaves numerous toward the base, size very variable, petioles slender, 2 to 3 inches long, leaflets 7 to 8, usually 7, oblanceolate, acute, mucronate, narrowed at the base, silvery-satiny alike above and below, ¼ to ⅓ the length of the petiole; spike 6 to 10 inches (including peduncle),

rachis strict; peduncles longer than the leaves. Flowers numerous and small, purple blue, densely set, mostly scattered or subverticillate above, pedicels short; bracts subulate, hirsute, twice the length of pedicels, extending to about half the length of the lower lip, persistent; upper lip 2-cleft, ⅔ the length of the usually 2-toothed lower lip; wings glabrous, oblong, obtuse; keel acute, somewhat woolly ciliate, chiefly near the dark purple apex: vexillum shorter than the wings, equalling the keel, banner shading to a white centre. Legumes hirsute, 2-seeded.

A very neat, symmetrical stool, of deep lilac blue spikes involved in dense clustered foliage of much beauty, with the aspect of an annual. Found at Donner Lake, summit of Sierra Nevada mountains, California, July 14th, 1870.

This cannot be *L. lepidus*, for that is herbaceous, without bracteoles, nor do the lips agree. It would seem nearer *L. meionanthus*, Gray., found about the same altitude (7,000 feet), and near the same region; but that has obtuse leaflet, and the calyx is without bracteoles — lips "nearly entire," while these are for the most part conspicuously cleft or toothed — *that* with an inflexed keel, with a broad, obtuse apex, *this* is very sharp, and can only be said to be erect. *L. Torreyi* has a red brown pubescence, and dense, long bracted racemes; should it even eventually prove a variety, we have as yet no adequate description of that species, to warrant the reference. Found near Lake Tahoe.

In many respects it is closely allied to *L. holocericus*, found on the islands and gravel banks of the Wahlamet, by Nutt.; but the pods of that have 3 or 4 seeds, *this*, 1 to 2; in this, the lower lip we have never found "entire," but with 2 rather cleft teeth (and rarely 3). In the remarks upon this species, of Nutt., it is stated that the upper leaflets are as long as the leaf stem (petiole).

Lupinus lacteus, Kellogg.

Stem annual, fistulous, the elongated central peduncle from a mere depressed crown, mostly solitary, spike 4 to 8 inches long, lateral radicle branches 2 to 6 inches long, with secondary clusters of leaves and (when present) shorter spikes, soft pubescent throughout, with white hairs. Leaves mostly clustered at the base, petioles membraneously expanding toward insertion and conspicuously 3-nerved, stipules adnate, subulate; leaflets 6 to 10, ½ to 1 inch in length, or about ⅓ the petiole, complicate-carinate, arcuate, spatulate, obtuse and slightly retuse, attenuate at base, sparsely appressed, pubescent above near the margins, glabrous toward the midrib, silky-pubescent beneath, colored at the point of insertion. Flowers large, white, somewhat distant, verticillate, chiefly by sixes, pedicels short, rather more than half the length of the persistent, subulate bracts; calyx ebracteolate, hirsute, scarious chiefly above, upper lip 2-cleft (rarely entire), about ⅓ the length of the lower lip, lower lip straight, herbaceous, 2-toothed, about ¼ of an inch long; vexillum glabrous on the back, ciliate at the marginal junction of the claw, face marked by a row of dark oblong spots along each side of the central fold, (rarely a few scattering dots,) banner, wings and keel about equal, wings oblong, obtuse, somewhat spatulate, about equal.

margins ciliate at the base or origin of the claw; keel ciliate at the upper inside margin toward the base, acute. Legume very hirsute, 2-seeded.

In habit and general appearance this species resembles *L. brevicaulis*, but is rather more robust, the flowers much larger and not "deep blue," but quite *white;* besides, the truncate upper lip is a peculiar distinguishing feature of that species — that has bracteoles on calyx, this *none*, etc. It is closely allied to *L. Menziesii*, but the relatively shorter pedicels, and much longer petioles, and both lips lacking the "entire" character and relative proportion, would strongly tend to exclude it; admitting *L. densiflorus* to be the same as *L. Menziesii*, "with variations," it would then bring us a "*dense*, subsessile spike," an *emarginate* upper lip, and *3-toothed lower one*, with which to contend. If these and many more varieties prove ultimately to run into one, it is not our fault; as the literature now stands, we are obliged, in self-defence, to set it apart, when called upon for determinations. Specimens collected by Mr. S. Brannan, Jr., on Oak Creek hillsides, Kern county, 14 miles from Tejon Pass.

Lupinus luteolus, Kellogg.

Stem 1-2 feet high, suffruticose, glabrous below, bark light creamy hue, satiny fibrous; minutely pubescent above, upright, flexuous and numerously branched towards the top, forming a very symmetrical, rather wheel-shaped cone; clothed with minute villi of white hairs. Leaflets about 8, oblanceolate, abruptly acute, attenuate at base, about ⅙ the length of the petiole, silky above and below; stipules setaceous, ¼ of an inch or more in length, adnate pubescent with longer hairs. Flowers light yellow, verticillate on short, stout pedicels, in a densely crowded spike 6 to 12 inches in length, the central terminal one straight and longest, those of the branches slightly incurved; bracts persistent, subulate, silky pubescent, mostly somewhat reflexed with the points ascending, as long, or extended beyond the lower lip of the calyx; calyx-tube scarious, very short and widely gaping, 2-bracteolate, bracts setaceous, ⅓ the length of the upper lip; upper lip ovate-lanceolate acute entire; lower lip herbaceous, 3-toothed, slightly deflexed and sub-saccated at the junction of the scarious portion, hirsute throughout. Banner glabrous, wings broad and somewhat inflated, glabrous, with scarcely a few hairs on the margins at the base; keel acute villous on the margins above at the lower third. Legumes very villous, 2-seeded.

Found on the Coast range of mountains, near Senal, Mendocino County, Cal., 1872.

This species does not seem likely to be confounded with any other in California. Few species in the *genus* have the *entire upper lip*. Donn describes *L. Sabinii* (a yellow Lupin of similar habit) *thus:* But that is described by all authors accessible to me, as *without bracteoles to the calyx*. Hooker says that has "*acuminate*" leaflets—*yellow* silkiness, and that the bracts are "*deciduous*," whereas, these are *persistent;* nor has our plant the upper lip "*bified*," as some describe it; besides, this is 2-*bracteolate*, a fact that cannot be overlooked; nor

have these specimens "elongated" pedicels, etc. It does not even rank in the same section. One of the most beautiful Lupins known to us.

Stephanomeria (?) *intermedia*, Kellogg.

Stems caulescent, one to four or more, from a fusiform perennial root (crowned by membranous relics of former radicle leaves), simple, or branches alternate, loosely erect, somewhat canescent pubescent, or puberulent, chiefly below; or sub-glabrous and glaucous, ½ to 1 foot high. Leaves variable; radicle ones lanceolate acute or acuminate, pinnatifid or laciniate toothed; lobes linear, acuminate; or in one variety entire; triplinerved or pseudo-triplinerved, blade decurrent into a long, slender winged petiole, 3-nerved at the base; cauline leaves at the 1st and 2d bifurcations on short petioles, 4th sessile sub-acute or obtuse, and the last on the terminal peduncle—when present—often scale-like or bractoid; peduncles axillary and terminal, mostly naked, long and slender; flowers large (for the genus) yellow, nodding before expansion; involucre ½ to ¾ of an inch in length, proper scales 7 to 9 in 2-series, herbaceous tips weak, waved acuminate, scarcely a little ciliate, membranaceous and finely nerved below; the short calyculate scales 6 to 11, in about 3 sub-series; florets 9 to 20 or more; ligules about ½ an inch in length, or ¼ of an inch longer than the exserted style and stamen-tube; achenia short truncate, scarce at all narrowed at the summit, glabrous, striæ very minute or obsolete, color dark brown, pappus *white*, of 20 plumose bristles, slightly thickening below and expanded into a broad hyaline base.

Two varieties are seen—one with more simple stem, smooth green and glaucous hue, leaves entire, rather smaller heads, fewer scales, florets, etc., appears to be a form with little else than reduced number of parts. Found by Mr. S. Brannan, Jr., myself, and Prof. Bolander, at Cisco, June, 1870. It was presumed to be *Crepis glauca*—by examination we find that it has neither the scabrous pappus, nor receptacle of crepis; but both the plumose pappus and favose or scrobiculate receptacle of *Stephanomeria*, although not agreeing in all points of the genus—as, *e. g.*, the "strongly 5-angled or 5-grooved achenia," yet it is thought best to place a plant of such doubtful character provisionally here, in company with *S.* (?) *chicoracea*, (See Proceedings American Academy of Arts and Sciences, May 30th, 1865, p. 552–3 of Prof. Gray), not doubting that it will ultimately form a new genus, or serve to revise those already existing. That it cannot be an *Apargedium*, as at present constituted, is evident, because it has not the "barbellate-denticutate capillary bristles * * * scarcely thickened downwards and *brownish*." This plant has also a proper stem, and not a "scape."

Pentstemon—Kingii var. *glauca*, Kellogg.

Plant glaucous throughout, and puberulent, not glandular; leaves obscurely 3-nerved and triplinerved above, mucronate apex recurved, decurrent winged petioles connate-clasping; anthers quite entire on the margins.

Found near the summit of Sierra Nevada Mts., July 10th, 1870.

Garrya Veatchii, Kellogg.

Shrubby, leaves thick, coriaceous, oblong or sub-ovate acute, mucronate, margins revolute, subentire, or obsoletely denticulate (?), upper surface sub-glabrous, often slightly frosted, hoary with short stellar wool, or shining minutely shagreened surface; beneath densely white lanose, 1½ to 2 inches long, ½ to ¾ of an inch broad, petioles short (1-7 to 1-8 the length of the blade). Young branches hoary. Fruit sessile on the rachis, in crowded, simple or compound racemes, densely lanuginous, 1½ to 3 inches in length; bracts subulate, apex elongated, but shorter than the fruit; male flowers not seen.

Collected by the late Dr. John A. Veatch, on Cerros Island, about 1858 or '9.

The President announced to the Academy that the recent donation of a valuable building site by James Lick had been promptly acknowledged by the Board of Trustees, and the following minute of proceedings, appropriately engrossed and framed, had been presented personally to Mr. Lick, accompanied by a letter from the President:

"At a special meeting of the Trustees of the California Academy of Sciences, held at their rooms February 18th, A. D. 1873, to take action upon the deed of property made by James Lick, of the county of Santa Clara, the following expression of the sentiments of the Academy was adopted.

"The unexpected and unsolicited gift of our fellow-member, James Lick, to the California Academy of Sciences, is so far beyond our sanguine expectations, that we cannot express to him in adequate words our heartfelt thanks for this maturely considered and munificent act.

"It emulates the richest bequests of Europe and the United States for assisting the pursuit of knowledge, and places every devotee of science throughout the world, and for all time, under the deepest obligations to the donor.

"The California Academy of Sciences accepts the deed with its conditions, and every member will strive to prove by his unremitting efforts to fulfill them, that the desire of James Lick 'to promote the diffusion of science' is deeply appreciated. Having struggled unaided, but hopefully, for twenty years in the cause of science on this coast, the members of the Academy are inspired with renewed faith in their efforts, and believe there is an awakened thirst for scientific research and knowledge, which will prompt our citizens to emulate the noble example of James Lick.

"The Trustees in a body will wait upon our benefactor to present these sentiments, and to offer the sincere thanks of the Academy for this exhibition of his munificent liberality, with the assurance of the personal efforts of every member to faithfully endeavor to carry out his wishes in the spirit in which they are made.

"George Davidson, President; John Hewston, Jr., Vice-President; Charles G. Yale, Secretary; Elisha Brooks, Treasurer; Robert E. C. Stearns, Oliver Eldridge, Thos. P. Madden, David D. Colton, Trustees."

The President, in remarking upon the subject of Mr. Lick's gift to the Academy, mentioned the sum of $200,000 as being needed to erect a suitable building, and to maintain the same when completed; and expressed the hope that the necessary amount can be obtained by the time specified in Mr. Lick's deed.

Dr. Hewston referred to a parasite in a *Haliotis* shell, from Pigeon Point, which had a specimen of the officinal sponge attached to it.

Prof. Davidson, in referring to a paper read at a previous meeting by Dr. Willey, on the gravels of Placer County, said that the writer thought that it was not the water alone that caused the gravel. Prof. Davidson thought that the occasional overflows of tufaceous lava had blocked the river and caused new channels, which were again similarly blocked, and opened; or that glacial action had aided the water in causing such large deposits of "cement" and partially worn gravel. A chemical analysis was needed to determine the nature of the "cement."

Dr. Willey said he meant it was not by water alone, but spoke of the immense deposits, and could not see that the ancient river system was so clearly marked out as was supposed. He was at a loss to tell how the cement could be formed by the mere action of rivers. Mr. Hanks had examined the cement and found that it contained the elements of granite. A reason of its formation might be found in glacial action. Another point he noticed was, the total disappearance of everything but quartz in that part of the country. The cement may possibly represent the pulverized granite. Many forces had been at work.

Prof. Davidson thought that if the cement should prove to be decomposed quartz, we could account for it by glacial action; but how can we account for the great abundance of rounded pebbles? Prof. Whitney's determinations of the elevations of the different gravel deposits above the American, and other rivers, had been plotted in sections, and exhibited an almost identical slope for the ancient river beds with that of the present beds of the American, and other rivers; although the positions of the last were from 1,200 to 1,500 feet below the former.

The President, for Mr. F. E. Durand, read a paper (translation from the Archives Neérlandaises of Harlem, by H. Vogelsang and

H. Geissler) "On the Nature of Liquids contained in some mineral substances."

A communication was received in reference to *Manna* and *Honey-Dew*, based upon the observations of Mr. John Applegarth, a farmer, long resident in the San Joaquin Valley. Specimens of honey-comb taken from the hives on his ranch near Woodbridge, were submitted. Mr. Applegarth being interested in subjects of this nature, has collected much information in regard to manna and honey-dew, which occurs at certain seasons in the region above-named. The appearance of manna is comparatively rare, as he mentions detecting it twice only—the fall of 1861 or 1862, and at the same season, 1872—both of these periods are coincident with and following summers of abundant verdure; these fertile summers were consequent to wet seasons after long continued drouths. The manna was discovered early in the mornings of the first cool weather in the fall, and covers the foliage and fences somewhat like frost—in the form of small, roundish, whitish grains or particles, quite sweet to the taste, and altogether agreeing with the description in Exodus, and in the writings of Josephus, of the manna upon which the Israelites subsisted during their sojourn in the wilderness; the honey-dew closely resembles that described by Josephus, even including the latter's remarks on honey-dew, which he says Moses found on his hands, and so described its nature, on the occasion of its descent on the Jewish host.

The honey-dew never fails to come in the early fall, covering the leaves and foliage of shrubs and trees with a thick, viscid, sticky substance, which soils the clothes and adheres to the hands and face, in passing through the thickets; it is sweetish, of a ranker taste, and not so agreeable as the manna.

The bees, however, busily collect both, and the comb-cells are found filled with both substances, at the close of the season. The honey-dew and manna, however, are never found in the same cells, but only in groups or patches (of cells), interspersed together in the combs.

In this connection, the idea that prevails among the farmers as to the origin of the honey-dew is not without interest; they account for it on the supposition that it arises from the sweet aroma of the countless wild-flowers which cover not only the plains, but

the hills and valleys of the adjacent mountains; said aroma being carried up by the rarified atmosphere, and condensed in the fall by the evening dews; the manna they think may be the pollen of flowers, and carried to the localities where it is found by the wind; not considering the fact that the manna occurs whether there is wind or not; and that it is altogether different in its essential features, such as weight, solubility, etc. It seems impossible, when its abundance is considered, and the wide area over which it is spread, that it could be deposited or caused by insects, as is generally believed.

Mr. Lorquin gave a description of a species of California vulture, recently captured by him. It differs from those described in the Pacific Railroad Reports and other works, having down upon its neck, instead of the neck being bare. The specimen measured nine feet ten inches, from tip to tip.

Regular Meeting, March 17th, 1873.

Vice-President in the Chair.

Thirty members present.

R. B. Irwin, J. H. Blumenberg, John J. Haley, A. B. Forbes, John F. Miller, J. A. W. Lundborg, M. D., I. C. Woods, S. D. Field, J. H. Smyth, O. P. Evans, W. A. Aldrich, Jacob Best, Michael Deering, A. W. Von Schmidt, Jourdan W. Roper, J. D. Howell and Laurence Kilgour were elected resident members.

James T. Boyd, Richard H. McDonald, M. D., Louis Sloss, William B. Hooper, F. Locan, F. E. Wilke, E. E. Eyre, Mark L. McDonald, Coll Dean, Horace L. Hill and E. J. De Sta. Marina were elected life members.

W. Lindeman, Phil. D., Otto Finsch, Phil. D. of Bremen, Germany, and Alexander Willard, U. S. Consul, Guaymas, Mexico, were elected corresponding members.

Donations to Museum: Egg of *Emeu*, from Australia, by W. N.

Fisher; specimen of a worm drawn from the pipes of the Spring Valley Water Company, by A. Gros.

Mr. S. C. Hastings stated, in correction of remarks made by him at a previous meeting, that he intended to say with emphasis, that he would unite with other gentlemen and be one of twenty, to raise the sum of $200,000 for building purposes, and that in pursuance of his proposition, he had placed his funds ($10,000) in the hands of one of the trustees on the terms proposed.

Descriptions of New Plants from the Pacific States.

BY A. KELLOGG, M. D.

Hesperochiron latifolia, Kellogg.

Root perennial, fusiform, fleshy, simple (or rarely subterraneously branched, 1–2 inches below the surface), leaves radicle, somewhat rosulate-clustered from the crown, ovate, obtuse, or ovate-oblong, sub-acute; blade cuneate and decurrent into a rather slender, slightly margined petiole, somewhat expanded at the base, 3 to 5-nerved, sub-glabrous, except near the hirsute and ciliate margins, and often along the petioles, more or less glandular above and below, or throughout, entire, or slightly repand sub-dentate, matured or fully developed petioles about as long as the blade (leaves 1 to 3 inches long, and ¼ to 1 inch broad); peduncles or pseudo-scapes, numerous (½ to 2 inches long), shorter than the leaves, compressed or sub-ancipital, nerved, chiefly hirsute along the edges, naked, or a single (reduced petiolate linear-lanceolate) leaf attached near the base or on the lower third; calyx deeply 5-parted, united from the adherent neck of the capsule into a broadly obconic base, unequal in width; base oblique, imbricate, 1 to 3 outer much larger, (at least twice the width of the inner) ovate sub-obtuse; 2 to 3 inner segments, oblong-ovate sub-acute, sub-pubescent on the back, united base often hirsute, pubescent within, nerved, margins ciliate, apex rather hispid; corolla large, broadly tubular-funnel-form or narrowly campanulate, border 5-lobed, lobes oblong-oval, often sub-acute (purplish-veined); corolla (sometimes somewhat irregular, but scarcely sub-labiate, whitish or pale bluish) longer than the calyx; stamens 5, unequal, filaments flattened (purplish) longer than the style, attenuated upwards, glabrous above, hirsute at the base together with the base of the tube; anthers introrse, oval, etc. Styles two, united or confluent below, (deeply 2-parted?) stigmas depressed-capitate, often slightly hirsute, (rarely obtuse and glabrous, and still more rarely with a 3-lobed style); capsule ovoid, or ovoid-oblong acute, apex hirsute, base obscurely glandular-2-valved, 2-celled, loculicidally dehiscent 20 or more seeded, seeds obovate, somewhat angled, papillose, and slightly crested at the hilum.

Found on the alluvial banks of the Yuba River, subject to annual overflows, damp, sandy and grassy plats at Cisco, C. P. R. R., Sierra Nevada Moun-

tains, at an altitude of 6,000 feet. Flowers sometimes purplish blue. June 19th, 1870, Kellogg.

Our reasons for making a distinct species from *H. Californicum* are, that the flowers are much larger — stigmas capitate — distinct leaves — two-edged peduncle often leafy—glandular character throughout, and calyx segments 2 to 4 times the size of Watson's species.

Heuchera rubescens—Torr. var. *glandulosa*, Kellogg.

Suffruticose base, scapes nearly naked or 1 to 3 subscarious hispid and cilliate scales of about 3 subulate setaceous lobes, middle lobe longest, bracts mostly similar, uppermost simply setaceous, shorter than the pedicels, a few scattered glandular hairs below, stipitate glandular chiefly above; leaves sparsely hirsute throughout, subcordate, subacute, slightly 5 to 7-lobed, unequally cut-dentate, setosely-mucronate, teeth acute; margin cilliate, petiole more hirsute with white spreading hairs, rather longer than the blades; panicle narrow, loosely many-flowered, somewhat secund, (?); calyx obconically campanulate, lobes erect, about equal, subspatulate, oblong, obtuse, as long as the tube, densely stipitate-glandular (a few long white hairs intermixed) colored, petals very narrow, linear-lanceolate, recurved, unginculate by a long, very fine filliform claw, longer than the genitals, stamens and styles exserted, filaments subulate, anthers roundish (colored), styles divergent, about the length of the stamens, immature ovules smooth?

Collected on Stanford Peak, C. P. R. R., at an altitude of 10,000 feet—July 29th, 1870.

Gnaphalium Nevadense, Kellogg.

Stem perennial, from a creeping rhizome, erect or somewhat ascending by the leading floral shoot, cluster branched at the base, barren branches secondarily clustered about 1 inch from above the crown, arenose-sating throughout; leaves below, and on the terminal tufts of barren branches spatulate, or subacute, mucronate 2–3-nerved, densely arachnoid-tomentose above and below, leaves of the scapoid or proper leading stem linear, acute, mucronate; 3 to 4 reduced bractoid leaflets at the base of the capitate crowded corymb; heads subsessile or on short pedicels; involucral scales oblong spatulate, obtuse, mostly lacerate-dentate, or sub-entire, exterior lanose-tomentose, somewhat herbaceous below; interior oblong scarious pink-tinged; pappus longer than the involucre and flowers, dense capillary very soft, white; achenia sub-glabrous, compressed.

It is thought that it cannot be the common G. *purpureum*, as it has no "axillary flowers," nor leaves "tomentose" only underneath, nor are the leaves at all "undulate," and by no means "obtuse," "green above," "racemose," or "spicate"—indeed, the achenia seems to be rather glabrous; if so considered, the description requires much amendment.

Œnothera quadrilvulnera, var. *hirsuta*, Kellogg.

Stem ascending, much branched above, shreddy fibrous bark splitting and exfoliating into thin papery lamina, short, somewhat appressed canescent pu-

bescent toward the top and branches; leaves on very short petioles or subsessile, entire (rarely dentate); calyx densely canescent hirsute; capsules very densely canescent hirsute, with rather long hairs; stigma purple, also the tips of the four shorter filaments.

Found by Mr. W. G. W. Harford, at Petaluma, June 7th, 1870.

Gilia capillare, Kellogg.

Stem annual, subsetiform, 2 to 3 inches high, simple, erect, or branching and somewhat flexuous, stipitate-glandular throughout, slightly viscid; leaves linear-lanceolate entire, or incisely lobed, oftener filiform, opposite below, alternate above, about ½ to 1 inch long, ¼ of a line wide. Flowers solitary, axillary and terminal, white; pedicels very slender, short (or rarely twice the length of the calyx) funnel-form, nerved, 5-lobed, lobes ovate, subacute, entire; filaments slightly shorter than the limb, inserted at the sinuses, anthers roundish (verditer blue), stigmatic lobes closed (?); calyx, lobes subulate, about equal the proper glandular tube of the corolla, or half the length of the flower, and scarcely longer than the obconic calyx tube. Capsule glabrous, ovate, 4-seeded (2 in each cell), seeds elliptic-oval, membranous-margined, without spiracles or mucilage.

Found at Cisco, C. P. R. R., Sierra Nevada mountains, July 6th, 1870.

Hymenopappus Nevadensis, Kellogg.

Root perennial, caudex thick and branching, crowns often produced from a half an inch to an inch or so; leaves clustered, and either radicle or subradicle, woolly-canescent, sparingly glandular, pinnatifid, rachis and petiole alike in breadth, equal in length, lobes spatulate, sub-lobed, toothed or entire; scapes 1–2 inches high, short-canescent-pubescent and stipitate-glandular, naked or leafy at the base, 1-flowered; heads large, cylindrical-campanulate, scales of involucre in 2-series, appressed, herbaceous, linear-oblanceolate, or narrowing toward the base, subacute or obtuse, sub-canescent-pubescent and glandular on the back, margin ciliate with frosty hairs and stipitate glands, tips lanuginous tufted, (half an inch in length or) shorter than the (yellow) florets, 10–14; receptacle naked, scrobiculate; achenia somewhat linear, compressed, sub-quadrangular, tapering to the base, striate, hirsute, apex not dilated, nor base constricted, (⅜ of an inch long), somewhat callous but no stipe, about 20; pappus scales 13, obtuse, somewhat spatulate, nerveless, equal, margins denticulate, chiefly toothed at the top, or emarginate with 2 conspicuous teeth, shorter than the achenia; florets of nearly uniform size, scarcely a little contracted below into the proper tube, sparsely hirsute and stipitate-glandular, 5-toothed, border revolute, teeth bearded on the back, branches of the style often unequal, revolute and with the stamens exsert, tipped with a short cone, obtuse, or one branch with a long, slender, filiform, hirsute acumination.

This plant is at variance with this and the allied genera—as is too often the case—but so closely allied to *Chænactis* it seems a pity to exclude it, yet it has no rays; and scales of the involucre only about half the required number; the receptacle also is not "alveolate" but scrobiculate.

The strange combination of a *Chænactis* stigmatic appendage on one branch of the style, and Hymenopappus on the other, of the self-same style, occurs so often that it is truly puzzling to the student. It should also be noted, that the pappus is scarcely more than half the length of the achenium.

On the other hand, as H., the achenia should be turbinated and contracted into a stipe. It does not, therefore, exactly tally with the generic description of H.; besides, the scales of the involucre are not (white) or petaloid, but strictly herbaceous. Having indicated its characteristics, it may repose provisionally here.

Macrorhynchus Harfordii, Kellogg.

Scapes wooly when young, more or less deciduous with age, or dispersed in growth, naked, or an occasional leaf upon the scape, several from a perennial, fusiform root, 12 to 18 inches high, a single large yellow flower, ligules often purplish on the back; fistulous, striate, subglabrous or sparsely pubescent, somewhat woolly at the base and summit. Leaves oblanceolate, subacute or obtuse, nerved and pseudo-triplinerved or twice triplinerved, nerves decurrent along the broad midrib, tapering into a long, winged petiole, more or less pubescent, ciliate more conspicuously near the base, pinnatifid, lobes short, remote, the very open sinuses often with a few intermediate teeth, about half the length of the scape—terminal lobe short, subacute or obtuse; scales of the involucre nerved, oblong-oblanceolate or sublanceolate, acute, entire, hirsute, and minutely glandular on the back, pubescent within above, outer herbaceous calyculate scales none, or rare; inner subscarious series linear lance-pointed, pubescent on the back toward the tip, margins and lower portion scarious, nerved, equalling the discoid pappus. Achenia obcompressed, lanceolate, apex acuminate, as long as the setiform beak, 8 or 9 obtuse ribs, deeply striate-sulcate, creamy white; persistent capillary pappus somewhat tawny, as long or longer than the stipe, outer and inner seeds similar and alike fertile. Receptacle alveolate, naked.

Found by Mr. W. G. W. Harford, at Petaluma, May 21st, 1870.

If this be supposed to be allied to *heterophyllus*, it must be remembered *that* is an annual plant, of dwarf habit, with a scape scarcely longer than the leaves, with an achenia undulate winged, and ⅓ the length of the filiform beak; a plant 4 or 5 inches high, slender, etc.

Macrorhynchus angustifolius, Kellogg.

Scape wooly-pubescent with articulated hairs, chiefly at the base and summit, erect or ascending, from a perennial slenderly fusiform root, 10 to 12 inches high, head cylindraceous, (slightly expanding in the dawn of sunny days,) rachis and lobes somewhat linear-attenuated, retrorsely-pinnatifid with deep broad rather uniform sinuses, lobes linear-lanceolate entire, commonly curved with an ascending sweep, lobes tipped with a (purplish) callous, or pseudo-gland, petioles slender, and like the base and summit of the scape wooly, mostly glabrous above, terminal lobe long (2 to 3 inches, or longer than the petiole), linear-attenuated; involucral scales acute, or sub-acute, the exterior foliaceous series short, half as long as the 2 or 3 inner sub-scarious series, lanceolate, or rarely

ovate-lanceolate, glabrous, canescent ciliate with articulated hairs; interior linear-lanceolate, acuminate, ⅓ longer than the pappus, obscurely herbaceous above, about 1 inch in length; receptacle alveolate, naked; achenia oblong, obcompressed, cuneate, glabrous and obscurely ribbed, the upper broader end abruptly narrowed into a (purplish) beak, scarcely longer than the achenium (or about 1 line); pappus of soft finely attenuate hairs equal or unequal, outer series successively shorter, inner nearly ½ an inch in length; florets with a long filiform tube often longer than the ligule, hirsute chiefly at the point of expansion. Flowers yellow. Mature achenia not seen.

Found at Cisco, C. P. R. R., Sierra Nevada Mts., at an altitude of about 6,000 feet, by Kellogg and S. Brannan, Jr., May 19th, 1870.

Probably most nearly allied to *M. retrorsus*, but in that the beak is "more than thrice the length of the achenium," or "¾ of an inch long"—a stouter plant than this every way. It also combines some of the characteristics of *M. humilis;* but that has entirely "hirsute" scales which are also "obtuse"; and a beak "more than twice as long as the achenium"—or "thrice," which would make that species *M. Lessingii;* but that is said to have a caducous pappus, etc., consimular scales, elongated ligules, etc.

Calais gracililoba, Kellogg.

Stems several from the same fusiform perennial root, branching, flexuous, puberulent and pearly-glandular throughout, few to many long axillary 1 flowered peduncles, with usually one or two simple linear-bractoid leaves, flowers nodding before expansion; radicle leaves with a linear-lanceolate narrowed rachis, very openly pinnatifid, or sub-bipinnatifid, lobes long and slender, sub-filiform, these again irregularly sub-lobed, the terminal one much attenuated (3 to 4 inches long), membranous expanded base sheathing, (about 6 inches in length, lobes 2 to 4 inches long); cauline leaves similar, upper and terminal lobes relatively longer; involucre cylindrical, scales in 3-series, bractoid scales ovate-acuminate 6—second or middle bractoid series 6, twice the length of the first or 2 to 3 lines, the proper involucral scales 8 to 12 in a double row, thrice the length of the last, lanceolate oblong acuminate, 7 to 9-nerved, short pubescent on both surfaces, chiefly on the back above, hairs black, margins scarious, cilliate; all minutely glandular on the back; achenia, somewhat obtusely 10-ribed, very minutely scabrous, sub-villous near the crown, not at all rostrate, base short-attenuate terete (23 or 4); pappus of 9 to 20 or more minute lance-linear entire scarious chaff, plumose awned from between the minutely bifid or toothed apex—pappus longer than the achenia—plume 8 or 9 times longer than scarious chaffy portion, slightly united into an extremely narrow ring at the lowermost base, requiring a little force to detach them; receptacle alveolate. Flowers pale yellow.

Found near Cahto, Long Valley, on Dry Creek banks, May 27th, 1869, Mendocino Co., Cal.

Probably a rare plant in that vicinity, as we have since searched diligently in order to obtain a supply for exchanges: it was recognized as new at the time, and then diligent search was made, but only three specimens obtained.

Calycadenia plumosa, Kellogg.

Stem annual, 2 to 3 feet high, bark creamy-white, villous and setose-scabrously hispid, fastigiately panniculate at the top, heads small (¼ of an inch in diameter) densely set on subracemose erect pseudo-simple branches, subsessile or sessile, subtended by numerous imbricated or crowded very minute leaves, or bractoid leaves (1 to 2 lines long), oblong or subspatulate, margins revolute, back margins, and apex above, hispid and glandular, a few large stipitate cup-shaped glands chiefly at the apex, always tipped with a similar gland. (The dry fragile proper cauline leaves at the base of the branches crumbled and lost.) Involucral scales (about 9), setose and scabrously hispid with white hairs, a few large cup-headed stipitate glands intermixed on the back mostly above; rays 7 to — (?), ligule broadly expanded, 3-lobed cuneate base attenuate to a slender hirsute and glandular tube; gray achenia obovoid attenuate towards the substipitate incurved base, obcompressed and obscurely triangular, grooved longitudinally, or about 10-angled, hirsute in lines, or along upon the ridges, gibbous above on the back, or oblique at the apex; chaff between the ray and disk flowers united nearly to the top into a 9-fold cup, acute hirsute on the back above, about 2 large stipitate cup-shaped glands at the summit; central disk achenia many (about 11) linear-oblong somewhat obcompressed, hirsute, 7-nerved; pappus of about 20, rather strong plumose seta in a simple series, gradually thickening from apex to base and slightly adherent in a ring at the point of insertion; disk florets (yellow), tube glabrous, sparsely pubescent above, 5-toothed; teeth erect, acute, stipitate-glandular on the margins, pistils included in the purplish stamen tube, or exsert, lobes erect spreading.

Receptacle flattish (but at maturity the accessories are deciduous, leaving it free to inspection, and in drying becomes convex), areolate and pseudo-pitted, the achenia being imbedded in the densely *villous* disk. Flowers yellow.

A plant sent to us from Stockton, by Express—friend and collector unknown, being absent in Mendocino Co. at that time: have learned nothing further.

Bahia cuneata, Kellogg.

Stem suffrutescent, decumbent, with numerous annual erect shoots and final ascending apex, white arenose-tomentose, also somewhat floccose throughout. Leaves opposite, cuneate-oblong, lower somewhat trilobed, lobes mostly dentate, 3-nerved; above and on the younger branches often simply tridentate, or more or less toothed at the top or upper third; uppermost alternate, base entire, tapering into a clasping petiole, rarely (1 or 2 in 200 or 300) palmately trilobed below the panicle, segments acute, more densely white lanose beneath. Peduncles rarely naked, comparatively stout (or about the size of the stem), 1 to 4 inches in length, more subarachnoid, 2 to 4 times the length of the leaves; involucre campanulate, scales in 2-series, ovate-oblong, acute or subacute, 8 or 9, equalling the rays, rays oblong-ovate, half an inch or more in length, orange yellow. Receptacle alveolate, not at all fimbrillate (margins of alveoli being quite entire); ray achenia minutely subvillous at the angles above, or subglabrous, scales of pappus about 5, very short, acute, finely and deeply

laciniate toothed, its ligule cilliate at the base, glandular; disk achenia very slightly villous upwards on the angles, chaff about 7 to 10, mostly acute, deeply laciniated, with very unequal sharp teeth, florets viscidly hirsute below, glandular above.

Found at Cisco, C. P. R. R., Sierra Nevada mountains, in January, 1870, by Kellogg and Brannan.

This Bahia seems nearest allied to an unknown or not sufficiently verified species, described by Nuttall, the *B. oppositifolia*. We have not been able to ascertain whether this is an annual or perennial — this point of comparison, therefore, must be waived. In this specimen, out of several hundred leaves, we find only *two* "palmately trilobed," and in these, the lobes are not "*obtuse*," "ligulate," etc., but *lanceolate*, and the middle lobe of *one*, *dentate*, as in the normal foliage; the peduncles are not "filiform," nor "*scarcely longer than the leaves*," the involucre of our plant is not even *cylindrical*, much less "oblong cylindrical," nor are the rays "*very* short"; these heads are strictly campanulate, as we approach the central and more perfect parts, the minute chaff of the seed is exceedingly *lacerate and acute;* finally, the plant has no special bitterness, to speak of. I have not been able to find any other species that so nearly approaches it as this, that would seem to require a further comparison.

Crepis occidentalis, var. *subacaulis*, Kellogg.

Leaves chiefly radicle, about the length of the perennial scapoid stem (3 to 4 inches high), simple (?) hirsute with scattering hairs, and short canescent pubescence, bearing a single head; leaves deeply pinnatifid, lobes toothed, points tipped with short, sharp, subspinous, corneous mucros, petioles about ⅓ the length of the blade, ⅓ cauline, the uppermost a sessile rudiment; involucre of 6 or 7 short, calyculate, appressed, lance-subulate scales, interior of 13 linear-lanceolate acuminate scales, margins scarious, nerved, canescent pubescent, tips hirsute; receptacle subalveolate chiefly at the margin; achenia 9 to 10-ribbed, tapering about equally to both ends, scarcely a little constricted or subrostrate, base slightly callous, outer fertile achenia about equal to the pappus, inner central shorter.

Found on the high peaks at Cisco, C. P. R. R., Sierra Nevada mountains, about 7,000 feet, June 27th, 1870, by Mr. S. Brannan, Jr., and myself.

This may prove to be a var. of *Nevadensis*, mostly with fewer parts and depauperate influences, owing to habitat.

Crepis occidentalis, var. *Nevadensis*, Kellogg.

Stem perennial, dwarfish, branching, panniculate-corymbose, canescent-floccose throughout; radicle leaves runcinate-pinnatifid or pinnatifid, deeply lobed, irregularly sub-lobed or toothed, teeth mucronate, consimilar rachis and petiole nerved, the margined petiole undulate near the expanded base, half the length of the blade (1–2 inches), cauline successively reduced. Involucre cylindrical, with a somewhat swelled base, the very short calyculate series (7), subulate from a broad base; interior (13) proper scales linear-lanceolate acuminate, foliaceous with

scarious margins, sub-ciliate, canescent-pubescent, scarcely equal to the pappus disk. Receptacle sub-alveolate, naked: achenia compressed, 9 to 10-ribbed, pappus scarcely a little thickened at the base, rigid, *shorter than the acheniun; achenia* very minutely hirsutish and serrulate scabrous upwards, about 30, gradually tapering upwards, but not rostrate. Flowers persistently yellow, floret tubes glandular, peduncles 3 to 5, 1–3 inches long, often with a minute bractoid leaflet, or sub-naked from the axils of leaves. Plant about a span high.

Found at the summit of Sierra Nevada mountains, June 16th, 1870. Altitude 7,000 or 8,000 feet.

This plant varies from the generic description of *Crepis*, for the inner proper scales are not in a simple series, but *double;* this is unimportant compared with the receptacle, which is that of a *Troximon*, being sub-alveolate; it agrees better with this in the rather rigid pappus, and decidedly in the large 5-crenated or lobed callous base; but then the pappus is not "longer," but *shorter* than the achenium. Yet, with these discrepancies, having the branching habit, and persistent yellow flowers — granting some future revision of the generic description — it is thought properly to belong to *Crepis.*

Although closely allied to *C. occidentalis*, it differs in not having "sessile cauline leaves" nor "blackish hairs"; besides, *C. occidentalis* has not a "striate achenia" as this has—the relative length of achenia and pappus is not sustained by our plant—some features are not wholly recognized in any allied genera or species—yet as this *C. occidentalis* is given a *variable latitude*, it is preferred to leave it here provisionally.

Nama racemosa, Kellogg.

Stem annual, 3 to 6 inches high, simple, erect, glabrous below, glaucous, purplish; branches opposite, decussate; at the second internode duplicate branches from each axil; divisions above naked or alternate from the axils of the leaves, second internode enlarging above, ancipitally expanded at the base of the leaves or compressed, and with the branches decurrent winged; stem leaves opposite, lanceolate acute or subacute, fleshy or succulent, subentire or slightly uneven outline, subwinged petioles very short, amplexicaule connate at the base, 3-nerved, subpubescent and pulvurulent, margins minutely scabrous ciliate, first and second pairs alternating or decussate (rarely a few other rudiments of leaves in the axils); first or primary raceme of the stem and branches mostly naked or bractless, emerging from one line to an inch below and opposite the leaf, simple (or branched?), a solitary axillary or subaxillary flower, distant and sometimes attached to the base of the common coiled peduncle, (1–2 inches long) flowers secund, pedicels short, or subsessile; calyx lobes unequal, sepals somewhat dilated upwards, short hispid and stipitate glandular (as throughout most of the summit of the plant) capsule globular, sparsely hispid above, 2–4-seeded, 1–2 in each cell—rarely less than 4-seeded.

Flowers tubular-campanulate, scarcely longer than the calyx, border 5-parted, lobes obovate, stamens somewhat unequal, and with the styles included. Flowers pale blue, verging to white.

Found by Kellogg and Brannan, at Cisco, Sierra Nevada mountains, July 6th, 1870.

The plant occasionally (in robust specimens) is doubly branched from each axil of the lower pair of leaves; leaves 1½ inches long to 2, and ½ an inch broad, repand subdentate. Rarely more than six inches in height.

Hedeoma (?) *purpurea*, Kellogg.

Stem about 1–2 feet in height, much branching from a ligneous base, quadrangular with prominent, rounded or obtuse angles and sulcate sides, angles somewhat retrorsely hoary-pubescent.

Leaves lanceolate, acuminate, sharply serrate, subpubescent above, pubescent beneath, glandular punctate, the sharpened base 3-nerved and triplinerved above, margin ciliate: 1–2 inches in length, ¼ to ½ an inch in breadth; petiole about 1-fifth the blade, hirsute; peduncles axillary, opposite, length variable, as long as the petiole, pedicels subsessile or even sessile, ¼ to ⅛ an inch in length, subdivided or mostly forked, bracts foliaceous linear lanceolate, hispid; bracteoles setaceous, former 2–4, latter 2–5; pedicels fasciculate-corymbose, 20 to 30 on each side, or flowers 40 to 60 in a whorl, longer than the calyx, subhispid; calyx tubular, prismatic, not gibbous at the base, hispid and glandular, bilabiate, 13-nerved (rarely less or more), upper lip 3-toothed, lower 2-toothed shorter, subulate from a triangular base, teeth hispid, throat naked; corolla bilabiate, upper lip flat, rather straight, 2-toothed or sublobed; lower lip 3-lobed, flat, lance-linear about equal, spreading, hirsute and glandular on the back, throat and middle lobe somewhat bearded or villous, genitals subexsert, style sub-2-lobed, equal, stigmas sub-glabrous with scarcely a few hairs; stamens, upper abortive pair often about equal, lower filaments always longest, being inserted lower, incurved at the apex. Flowers purple blue; calyx often colored.

Found at Webb's landing, on an island of the San Joaquin River, fall of 1872. A stout or robust species, much branched; with the usual strong odor and carminative properties of the common Pennyroyal; perhaps from a perennial root; seeds ovate, truncate at the hilum; surface minutely thimble-pitted or superficially scrobiculate.

This plant, it may be said, cannot belong to *Hedeoma*, for the throat of the calyx is not bearded. Nor can it be a *Pogogyne*, for that has the regular *four-stamened* character, and the tube of the corolla is naked inside. My own judgment is, that the genus *Hedeoma* should be so reconstructed as to receive this and some others; I therefore place it provisionally here, as indicated. It cannot be a *Keithia*, for although that has a naked throat in some species, it has not even a vestige of upper or posterior abortive stamens, as this has. Nor can it belong to *Gardoquia*, for similar reasons.

In the new genus *Poliomintha*, Gray., the calyx still has the villous ring — this, none; that, like this plant, has a somewhat pilose throat of the corolla, but the stamens are not incurved—cells are spreading, and the sterile pair *very short* — seeds smooth, etc. There are often seen fragments of abortive anthers on the short pair of anthers of this plant.

Heuchera Californica, Kellogg.

Scapoid-panicle ascending from a perennial creeping rhizom, 1 to 2 feet high, 2 to 3-leaved, largè (5 to 7-lobed) below; fimbriate-bracted above on the rachis, floral top elongated, narrow, loose, lateral peduncles bi-ortrichotomous; cymules very short; plant hirsute, with long spreading glandular hairs throughout; radicle petioles and base of the nerved and sulcatescape, rather hispid; hairs somewhat fulvous, or dirty white. Leaves roundish-cordate 5 to 12 or more lobed, lobes short, obtusish, crenate-serrate, teeth abruptly acute, mucronate, margins minutely ciliate, sparsely appressed-hirsute above (with white hairs); hirsute beneath, chiefly along the veins; the radicle leaves on long petioles (3 to 6 inches), base short expanded, strongly nerved. and scarcely at all membranous (lamina about 2 to 3 inches broad); bracts fimbriate, very attenuate filiform lobed (colored reddish); rachis, peduncles, pedicels, calyx and capsules, stipitate glandular; calyx colored (white), large, spreading, bell-form, nodding, segments ovate, sub-acute, somewhat unequal, ciliate with stipitate-glands; petals (white) filiform attenuate-acuminate (about equal, finer than filaments,) persistent; filaments (8 to 10) unequal, anthers roundish; styles long, and with the stamens exserted; capules ovate-acumnate densely stipitate-glandular.

Found by Kellogg and Brannan, on the San Gregorio Creek, San Mateo Co., Cal., May 2d, 1870.

This species is not liable to be confounded with other allied forms; at least, with any of the *naked scape* species, as this plant has 3 large well-developed leaves of the scape on petioles, from ¼ to about an inch in length; besides, *H. cylindrica*, *hirtiflora*, or var. *pilossima*, *H. bracteola*, or *H. rubescens*, etc., have stamens and styles too short or included, or if not altogether naked, the rudimentary leaves are mere lacineæ or abnormal leaves. It would be useless to draw parallels in details, where the special differences seem so numerous.

Lagophylla minima, Kellogg.

Stem annual, erect, simple, or sub-simple, densely hirsute with long spreading articulated hairs throughout, low and slender (4 to 6 inches); early radicle and lower cauline leaves spatulate-lanceolate, acute, decurrent into narrowly winged petioles, about as long as the blade, base clasping, very minutely and remotely cut-dentate, obscurely 3-nerved and tripli-nerved above, silvery shining, somewhat appressed satiny-hirsute, lower leaves opposite; upper alternate sub-sessile and sessile, linear-acute, apex callous, surface pappilose (*cutis-anserina*) roughened.

Heads terminal (rarely a few axillary at the summit) short peduncled (or sub-sessile). Involucral leaves of the *first series* similar to, but reduced form of upper cauline, or pseudo-bractoid 5, spatulate-cuneate, flat, loosely erect, spreading, densely hirsute, chiefly so along the margins (hairs long and beautifully jointed), few large glands along the lamina above; *second series* also of 5, ovate-lanceolate, infolding entirely the ray achenia; rays pale yellowish, 3-toothed, 3-nerved (indigo-purple) broadly fan-shaped; cuneate base somewhat abruptly

narrowed into a short pubescent tube; third series also 5, (the proper chaff) linear-lanceolate, acuminate, the cuneate base colored, somewhat scarious margins ciliate villous on the back at the tips, slightly carinate, distinct, central florets about 5, staminate, and pistillate, abortive, 5-toothed, stamens purple. tip of filaments purpled below as if articulated. Receptacle conic (?), fimbrillate (?), punctate, apex or centre hirsute (with a pencillate cluster of hairs). Pappus none.

A small slender annual of micropoid similitude, with opposite dentate lower leaves, and remarkable jointed or articulated hairs, with the general aspect of a *Filago*, *Calymandra* or dwarfed forms of *Gnaphalium*. Found by Mr. S. Brannan, Jr., at Oakville, Napa Co., Cal., May 2d, 1870.

This little plant will now enable us to arrange and separate true generic characteristics from the adventitious, reverting the partial and subordinate only to specific importance, *e. g.*, "perennial" (?), "glabrous," "sessile-heads," "involute margins," etc., will only apply to *L. ramossima* of Oregon, but not to our plant—description provisionally well enough when one species of a new genus is known. The fact of an extra pseudo-series of involucral envelopes would do little violence to nature should others view them as merely bractoid.

Trifolium pauciflorum (?) var. *parvum*, Kellogg.

The following species or form does not well agree with the description; *e. g.*: The plant is by no means "glabrous," but hairy throughout, or nearly so; nor are the upper leaves "lanceolate-linear acuminate," nor "*distantly* and minutely spinulose-serrulate," nor involucre "many-cleft," but only 5 to 6 — much less "12–16," etc. Therefore we give the following description, as notes to further comparison; to wit:

Root perennial.

Stem very slender, ascending or somewhat erect, much branching or spreading from the base, sparsely soft silky hairy nearly throughout, 4 to 6 inches high.

Leaves very long petioled (6 to 7 times the length of leaflets), 2–3 inches; leaflets obovate obtuse, or upper short acute, base cuneate, spinulose-serrate, often toothed at the apex, strongly pinnate veined, glabrous except the pubescent midrib beneath, short-petiolulate (1-line); blade 3 lines to half an inch long, 2 to 3 lines broad; *petioles* very slender, about as long as the peduncles, *peduncles* axillary, filiform, hairy; *stipules* lanceolate acuminate, from a rather broad base, lacineate-dentate or entire; *involucre* monophyllous, 5 to 6-cleft, lance pointed, spinulose-mucronate, 9-nerved at the membranaceous base of the cup, 1–2 florets, rarely more; *calyx* on a short, hirsute pedicel (about 1 line), tube sparsely hirsute, membranous at base, pubescent, 10-nerved, (marginal nerves meeting at the axils of the teeth and confluent into the more obscure alternate nerve,) teeth lanceolate-subulate-pointed, upper pair shorter, or subequal; *corolla* tube rather more than twice the length of the calyx, pubescent with long silky hairs; *banner* large straight ovate limb longer than the narrow oblong wings, and both ochroleucus or whitish; *keel* very short abruptly acute point, subincurved, deep purple or varying to indigo blue. *Pistil* clavate, point incurved above, beak retrorse.

Damp, sandy or springy and somewhat half shady places; Cisco, altitude 6,000 feet, Sierra Nevada mountains. July 6th, 1870.

Solidago elongata, var. *microcephala*, Kellogg.

Stem subglabrous below, pubescent with white jointed or frosty hairs above, strict, somewhat obtusely angled by the decurrent strongly 3-nerved midrib of the expanded base of the leaves, 3 to 5 feet high; racemose branches erect, at length somewhat recurved, and subsecund, forming a dense, large, broadly pyramidal panicle (6 by 8 inches or so,) leafy, with the reduced lance-linear leaves intermixed at the base.

Middle and upper cauline lanceolate acute or subacuminate, cuneate base 3-nerved, sessile, subamplexicaule, strongly triplinerved above, these and midrib sharply prominent below; lateral nerves of the base obscure finely reticulate veined, to the unaided eye, more manifest by transmitted light, subglabrous above and below, sparsely scabrous pubescent along the veins and midrib; margins densely incurved-ciliolate scabrous, doubly serrate, alternate or interrupted teeth long narrow, or lobe-toothed, teeth subulate pointed with a callous mucro, short apex and longer base entire, upper surface slightly shagreen roughened, racemose branches pubescent, pedicels minutely scabrous-pubescent, bracts and bracteoles filiform subulate; heads very small, rays exsert but verging to invisible; involucre scales 15 to 22 or more, exterior shorter subulate acute, interior linear subacute, minutely pubescent on the back, ciliate pubescent at the tip, scarious margins laciniated, colored (yellowish), often a few conspicuous teeth at the apex; rays 15 to 16; disk florets 9 to 10, achenia pubescent, disk pappus about the length of the forests, or about twice as long as the achenia; receptacle alveolate, naked.

Found at Webb's Landing, Island of San Joaquin River, late in fall of 1872.

Triplinervæ, section *Solidago*.—As the relative number of parts, etc., are not given in descriptions of *S. elongata* and some of its allies, as *S. serotina, S. Canadensis, S. gigantea*, etc., it was deemed best to give ample details, if need be, for comparison or amendment. Although placed under *S. elongata* (Nutt.) it is by no means "*obscurely* triplinerved," for the triple nerves and midrib are conspicuously and sharply prominent beneath; the expanding base of the midrib is strongly 3-nerved and thence decurrent along the stem; heads remarkably small (little more than a line in diameter,) for such a large and vigorous plant; involucral scales more than 20 (15 to 22); rays numerous, exsert but indistinct, except by careful inspection; or in general, the exceeding number of parts, though common to all, attain to the rank of distinctive characteristics where disparity is so great; added to special points, it is thought to entitle it to the consideration, at least, of a variety. It is hoped some simpler and more generous revision may be adopted, which will include all these in one, with due recognition of sub-species and varieties.

Erigeron discoidea, Kellogg.

Stem strict, sulcate-striate, hirsute-pubescent throughout, branches erect,

densely racemose-paniculate into an oblong pyramidal top, leafy throughout, 2 to 3 feet high. Leaves oblong-spatulate-cuneate, sessile or with a short winged petiole, obscurely triplinerved above, 3-nerved, decurrent parallel with the midrib at the base, sub-clasping, lower cauline pinnately-lobed, pinnatifid-toothed above, lobes and teeth subulate-mucronate with a callous point, margins pubescently-ciliate, hirsute below, pubescent above, upper leaves successively reduced to lance-linear, linear, and final filiform bracts; lamina thin, flaccid; involucral scales in 2 to 3 series, linear-lanceolate acuminate very attenuate, hirsute on the back, inner series with scarious margins, minutely laciniate-toothed, shorter than the white pappus; rayless, nodding before expansion, at length erect; florets 4 to 5-toothed, tube filiform, throat and border campanulate, lobes lanceolate acute recurve-spreading, often stipitate-glandular, as also the tube; stamens and style somewhat exsert, about as long as the pappus; achenia sparsely pubescent and glandular chiefly above, those of persistent florets, both pistiliform and stameniferous but abortive, densely clothed with pappilose glands, short-stipitate callous base, or neck and base constricted compressed, oval-oblong slightly broader above, white scabrous pappus simple; receptacle scrobiculate, naked at length produced into sharpened points.

Found on an island of the San Joaquin River, Webb's Landing, late in autumn of 1872. At first it was thought to be a variety of *E. Canadensis*, but a more thorough examination seems to warrant a new species. Heads evidently hermaphrodite, the central florets masculine, this portion of the receptacle being simply areolate, the outer florets feminine and fertile; more closely allied to *E. rivularis*, D. C. Prod., vol. 5, p. 288.

Mr. Dall read and submitted the following paper in behalf of the author:

Note on the Scombrocottus salmoneus of Peters, and its identity with Anoplopoma fimbria.*

BY THEODORE GILL, M. D. PH. D.

The distinguished zöologist of Berlin, Dr. Wilhelm Peters, has recently published a communication on a supposed new generic type of "Cataphracti," from Vancouver's Island, which he has named *Scombrocottus salmoneus*. This form was regarded as possessing the highest interest, on account of a combination of characters which allied it to the Scombroids, and thus corroborated Dr. Günther's views respecting the affinity between the Cataphracti and Scombroids of Cuvier.

It was at once apparent, after a perusal of the good description, that the supposed new type was identical with the form first discovered and named by Pallas, *Gadus fimbria*; and subsequently by Dr. Ayres, *Anoplopoma merlangus*. And it was with special interest that I also recalled the fact that both its former describers had failed to perceive any resemblance to the Scombroids (they

* Printed in advance, April 9, 1873.

equally failed, however, in detecting the relations to the Cataphracti), and both had believed they could perceive a resemblance to the Gadoids;* this was the more noteworthy, as the later observer was ignorant of the labors of his predecessor; and it was also with interest that I perceived that Dr. Peters had likewise been struck with a resemblance of the same form to the trout; naming the species *S. salmoneus*, and describing it as trout-like (Habitus forellenähnlich). Now it is evident from a study of the anatomy, that these several forms are very dissimilar in fundamental characters; and most of them, at least, quite distantly allied. A likeness which is so ambiguous as to mislead persons equally familiar with the external appearance of the several forms, and to lead to such dissimilar results, must be of very slight importance. At any rate, the affinities of the form in question (*Anoplopoma fimbria*) with the Cataphracti—and more especially the Chiridæ—are evident from an examination of the external and internal structure; and I am unable to appreciate the likeness which others have seen to the cods, the mackerels, or the trout.

The synonomy of the species will now stand as follows:

ANOPLOPOMA FIMBRIA, Gill, *ex* Pallas.

Gadus fimbria, *Pall.* Zoög.—Ross.As., III, 200, 1831.

Anoplopoma merlangus, *Ayres*, Proc. Cal. Acad. N. S., II, 27, 1859.

Merlucius (?) [fimbria], *Grd.*, Expl. P. R. R., VIII, Fishes, 141, 1858.

Merlucius [fimbria], d. sp., *Gthr.*, Cat. Fishes, IV., 344, 1862.

Anoplopoma [fimbria], *Gill*, Proc. Acad. N. S. Phila., 1863, 247.

Scombrocottus salmoneus, *Pet.*, Monatsb. Pr. Akad. Wiss. Berlin, 1872, 569.

Mr. Stearns read a paper, illustrated by drawings, on certain Xylophagous, or wood-eating animals, referring especially to the *Teredines* or ship worms, among the mollusks, *Limnoria* and *Chelura* (gribbles) among the crustaceans, which occupy marine stations, and the *Termites* or white-ants among the terrestrial Xylophaga. Mr. Stearns called the attention of the Academy to the importance of the cultivation of the *Eucalyptus marginata*, as the wood of this tree is exempt from the attacks of all the above species, and therefore particularly adapted to structures of wood for marine positions.

Descriptions of New Species of Mollusca from the Coast of Alaska, with notes on some rare forms.†

BY W. H. DALL, U. S. COAST SURVEY.

While the final description and thorough examination of the collections of marine invertebrates, made by me on the coast of our new Territory, are necessarily delayed, it seems desirable to put on record a few of the more striking

* Dr. Ayres noticed the enlarged suborbitals, but referred the genus near to Stizostedion (Lucioperca Cuv.).

† Printed in advance, April 9, 1873.

facts, and to describe some of the more remarkable forms which have thus come under my notice. I have already given to the Academy preliminary descriptions of a few of the species which appear to have been hitherto unknown, and this paper contains additional material of the same kind, though my time has been so much engaged by other and more pressing duties, that a very large amount of work of this kind still remains unfinished.

In the matter of distribution it has been pretty well demonstrated by our researches that three faunæ come together and are more or less intermingled in the region between Unalashka and the Shumagins. The Shumagin group of islands, jutting out from the main land and deflecting the coast current more or less to the southward off shore, acts toward the Oregonian fauna (which I extend from Monterey to the Shumagins), as Cape Cod on the east coast of North America does to the fauna which characterizes the coasts of the Middle and Southern States.

In this group many of the characteristic animals of the Oregonian fauna, such as *Mytilus californicus*, *Purpura lactuca*, *Amphissa corrugata*, *Mœra variegata* and *Petricola carditoides*, attain their most western limit. The Arctic fauna which characterizes the shallow waters of Bering Sea and the Arctic Ocean, is well represented by forms of *Astarte*, *Buccinum glaciale*, *cyaneum* and *ciliatum*, *Scalaria grönlandicum*, *Cardium islandicum*, *Lacuna vincta*, several species of *Bela*, *Admete* and *Odostomia*, and many others which pass, in most cases, but little to the eastward. The typical Aleutian fauna, which was (up to the commencement of our researches in 1865) almost unknown, is characterized here by such species as *Pecten alaskensis*, *Drillia Kennicottii*, *Rictocyma mirabilis*, *Voluti Stearnsii*, *Magasella aleutica*, *Litcrina aleutica*, *Acmæa sybaritica*, *peramabilis* and *Nacella rosea*, *Heliotropis harpa*, and other forms described in this paper. Much remains to be done in tracing the course and characteristics of this fauna to the westward, which I hope during the coming season to elucidate to some extent. The following species possess peculiar interest as being unlike the forms which would be expected in so high a latitude, and as an earnest of what may be looked for in future explorations.

Cancellaria (*Trigonostoma*) *unalashkensis*, n. s. Pl. II, fig. 1.

Shell slender, acute, of six whorls, with a minute, smooth, white nucleus and solid texture. Color whitish with traces of a nut-brown epidermis. Sculpture of strong revolving ribs, of which the posterior three are crossed by rather strong transverse riblets which rise into beaded nodules on the intersections. The whorls are turrited by the prominence of the posterior revolving rib, between which and the suture the transverse riblets are oblique and rather strong. Three of the revolving ridges are apparent on the upper whorls and seven on the last whorl. Aperture about two-fifths the whole length, white, with a pink throat, and the outward lip somewhat thickened and internally grooved, corresponding with the external ridges, which are also apparent on the inner lip. Canal short, straight, shallow and rather narrow. Two or three plicæ on the columella. Animal whitish with no operculum. Lon., 0.75 in.; lat., 0.3 in.; defl. 35°.

Habitat.—30 to 60 fathoms stony mud in Captain's Harbor, Unalashka, Aleutian Islands; three living specimens. *Cancellaria modesta*, Cpr., was also found here, but not in the deeper water.

Cancellaria (Trigonostoma) circumcincta, n. s. Pl. II, fig. 2.

Shell similar in form to the last, with six whorls, nucleus minute and nearly smooth; thin and delicate; whorls sculptured with strong revolving ridges, generally subequal, but with a few more slender intercalary threads; turns gently rounded with a very slight tendency to tabulation toward the posterior third of the whorl; crossed by very faint transverse irregular riblets, which are most evident on the apical whorls and evanescent on the body whorl, and show a slight tendency to granulation at the intersections only on the first two or three whorls. Color rose pink, strongest on the ridges. Outer lip thin, delicate, the sculpture of the exterior showing through; inner lip not thickened; columella white with two or three very faint plicæ. Animal slate color. Canal short but deeper than in the last species. Lon., 0.82 in.; lat., 0.37 in.; defl., 40°.

Habitat.—Popoff Strait, Shumagin Islands, in ten fathoms stony mud about the reefs.

Sipho Hallii, n. s. Pl. II, fig. 3.

Shell fusiform, solid and heavy, of five and a half whorls, the last much the largest; suture subcanaliculate, not deep, but very distinct; whorls moderately convex, somewhat appressed toward the suture. Canal rather long, much recurved; aperture elongate, acute behind; inner lip much thickened, white; outer lip hardly thickened, posteriorly waved. Shell covered with a yellow-brown epidermis, with very faint revolving striæ, crossing the slightly evident waved lines of growth.

Lon., 1.7 in.; lat., 0.8 in.; lon. apert. 0.95 in.; defl. 45°.

Habitat.—Sanborn Harbor, Nagai; three dead specimens, with *Paguri*, found by Capt. W. G. Hall, sailing master of the U. S. C. S. Schr. Humboldt, to whom I am indebted for many valuable additions to our collections.

This species is smaller and more solid than most of the genus, and does not resemble any of the east coast species closely enough to require a comparison. It has a little the aspect of a *Campeloma*, in some of its characters.

Margarita vorticifera, n. s. Pl. II, fig. 4, *a*, *b*, *c*.

Shell depressed, with three flattened, rapidly expanding whorls, which have a tendency, in old individuals, to overhang the suture anterior to them. The upper surface is traversed by numerous slender, slightly elevated, revolving threads, which are crossed by faint lines of growth. Outer edge of whorls subcarinate. The basal surface is less flattened, but similarly sculptured, except that the very wide and funnel-shaped umbilicus is destitute of revolving striæ, and the lines of growth are here a little stronger. Aperture excessively oblique, with the anterior angle much produced; lips hardly thickened, and but slightly interrupted at the junction with the body whorl. Nacre, salmon-color; exter-

nal surface pinkish white, brilliantly pearly where eroded. Lat. of largest specimen, 0.85 in.; alt., 0.5 in.; defl. 88°.

Habitat.—Iliuliuk Harbor, Captain's Bay, Unalashka; and larger specimens in the Akutan Pass, from ten to sixty fathoms, on stony bottom. Not found in the Shumagins.

This species is more flattened than any species except *M. helicina*, which it somewhat resembles in form, though more carinated, and otherwise widely differing in character. It is not allied to any West American species known to me, though it may have relations in some Japanese form. It is a thin and light shell.

Volutopsis Beringi, Midd., var. *regularis*, Dall. Pl. II, fig. 6.

Shell of four whorls, obtusely fusiform, and with the last whorl somewhat inflated. Nucleus mammillated, whorls smooth, moderately convex, with a distinct, though not channelled suture. Aperture eleven-seventeenths the length of the shell, elongate, produced in front, with the outer lip moderately thickened and the inner lip without callus. Canal almost straight; short, narrow. Lon., 1.8 in.; lat., 0.9 in.; defl. 65°. Color white, or light pinkish.

Habitat.—Unalashka, to the Shumagins; rare. This form may be a distinct species, but I have preferred to indicate it as a variety, for the present. It differs from the normal form in being smooth and regular, without the lumps or irregular ribs which are common in the *V. Beringi*; it is smaller in size, when adult, by one-half; it is never of the dark livid chestnut color which invariably characterizes *V. Beringi*. The outer lip is less patulous, the canal proportionately narrower, and the aperture shorter, compared with the whole length of the shell. Moreover, the specimens are remarkably uniform in their characters, and the *V. Beringi*, though very variable as a whole, is equally constant in the differential characters alluded to. I have come to this conclusion only after a careful examination of over a hundred specimens of *V. Beringi*, and a good series of this form. The former is much more common in the localities alluded to.

In Dunker's portion of the *Novitates Conchologicæ*, pp. 1–7, 1858, and plates I and II, a number of species are described and figured as new, and stated to be from Sitka. The references to the plates are erroneous throughout, as pointed out by Dr. Carpenter, and the names on the plates do not always agree with those in the text. Of the six species described here, only one is new. As the paper is not accessible to most students, I here give the corrected synonymy of the suppositious species, none of which are found at Sitka.

1. Buccinum glaciale, Stimpson. (Mon. Northern Buccinums.)

{ *Tritonium carinatum*, Dkr., p. 1, pl. 2, f. 3–4.=
{ *Tritonium angulosum*, Mœrch. (on plate.)

Tritonium mœrchianum, Dkr., p. 2, pl. 2, f. 1–2.
Tritonium rutilum, Mœrch., p. 3, pl. 1, f. 5–6.
Tritonium rombergi, Dkr., p. 4, pl. 2, f. 5–6.

All these varieties of the well known *Buccinum glaciale*, are beautifully and thoroughly connected by the really magnificent series of that species obtained by us during the season of 1871–2, in the Aleutian Islands. It belongs to the Arctic fauna.

2. *Volutopsis Beringi* (Midd..) A. Ad.

Tri'onium Beringi, Midd. Mal. Ros. p. 147, pl. iii, f. 5–6. 1849.

(? *Volutopsis norvegica*, Chemn., N. European seas.)

Neptunea castanea, Mœrch., p. 7, pl. 1, f. 1–2.=

Neptunea badia, Mœrch. (on plate.)

This species, if not identical with the European form, is a member of the typical Aleutian fauna.

3. *Chrysodomus* (*Heliotrcpis*) *harpa*, Dall, *ex* Mœrch.

Neptunea harpa, Mœrch., p. 2, pl. 1, f. 3–4.

This is an Aleutian species, found from the Shumagins to Unalashka, but everywhere very rare.

It belongs to a group characterized by thin sinistral shells, with mammillated apices; an operculum very small when compared with the size of the animal; solitary ovicapsules of hemispherical form, attached by the entire base, smooth above, and maturing only two or three individuals to each sac, although of much greater size than the ovicapsule of any other species of mollusk in the region; and, probably, by dentition. This group may take the sub-generic name of *Heliotropis*. Our largest specimen exceeded six inches in length. *Fusus contrarius*, of authors, of the North European seas, may also belong to this group.

Buccinum Dalei, Sby., or a related form, was found by us at the Shumagins.

Pleurotoma circinata, n. s. Pl. II, f. 5.

Shell slender, elongate, covered with a brownish epidermis; whorls six, with a single, sharp, narrow carina, about the middle of the whorl, in the upper whorls; this carina does not interrupt the even rotundity of the whorls so as to produce any flattening of the latter, but appears as if it had been placed upon the equator of the whorl, after the latter had been completed. The posterior surface of the carina and that part of the whorls behind it, are destitute of any but the most microscopic revolving striæ, though plainly marked by the deeply notched lines of growth. The anterior surface of carina and whorls is covered with sharp, revolving grooves, with wider interspaces, being about twelve on the body whorl, between the posterior edge of the aperture and the carina. The notch is deep, and about one-third of the way from the carina to the suture. Aperture and canal long and narrow; outer lips, before the carina, effuse. Nucleus, white. Lon. 3.0 in.; lat. 1.0 in.; defl. 42°.

Habitat: Nateekin Bay, Captain's Bay, Unalashka; one specimen, dead on beach.

This species was at first supposed by me to be the adult form of *Drillia Kennicottii*, Dall, but on comparison, I find them distinct, as the latter has nearly as many whorls in less than a third of the length, and the carina is duplicated

in the last whorl. The latter comes from the Shumagins. The present species is one of the peculiar species which combine to form the Aleutian fauna.

Plate ii, fig. 7, represents *Clathurella affinis*, Dall, Am. Journ. Conch., Vol. VII., p. 102, 1871, a hitherto unfigured species from Cape St. Lucas, also from San Miguel Island, off the southern coast of California, where it was detected by Mr. Harford.

Regular Meeting, April 7th, 1873.

President in the Chair.

Thirty-five members present.

Samuel F. Reynolds, Henry H. Haight, and Samuel C. Gray, were elected resident members.

Donations to Library: Washington Zones, 1846–1849, from the U. S. Naval Observatory, 2 vols. Proc. de la Societie Malacologique de Belgique, pp. 83–98, 1872. Proc. Acad. Natural Sciences of Phila., 1873, pp. 1–40. On the Right Ascension of the Equatorial Fundamental Stars, etc., by Simon Newcomb, from U. S. Naval Observatory, Washington, D. C. Uber die Salzseen des Westlichen Tibet. Allgemeiner topog. Erlanterung Hochasiens; von Hermann Schlagintweit—Sakunlunski. Supp. Cat. Lib. Co., of Phila., Jan. 1873. Sveriges Geologiska, Undersökning, parts 42–45, with four charts from Bureau Géologique de Suède. Select Plants, eligible for Victorian industrial culture, etc., etc., by Mueller. presented by Edward Bosqui. Bull. of Mus. of Comp. Zoölogy, Vol. III, No. 6. Notes of an Ornithological Reconnoissance in Kansas, etc., by J. A. Allen. Vol. III, No. 5, Fossil Cephalopods of the Mus. Comp. Zool., by Alpheus Hyatt. Proceedings Boston Society Nat. His., Vol. XV, Part I, Jan.–Apl., 1872. Eng. and Mining Jour. Am. Jour. Science and Arts, Jan., Feb. and Mch., 1873. Am. Naturalist, Jan. and Feb., 1873. Am. Chemist, Dec. 1872. Overland Monthly, Mch., 1873. California Horticulturalist, Jan., Feb. and Mch., 1873. Monatsbericht der Konig. Preuss. Akad. der Wiss., zu Berlin, Aug., Sept., Oct., 1872. Review of Lyell's Elements of Geology, by John B. Perry, pamph., 8vo., 1872. Monographie des Chrysomélides de l'Amerique, par C. Stal, from the author. Forest Culture in its relation to Individual Pursuits, by F. Von Mueller, pamph., 8vo., 1871. Kingsborough's Mexican Antiquities, 9 vols., imp. folio, half Turkey morocco, gilt, presented by George C. Hickox, Esq.

Donations to the Museum: Two species of Crustaceans, a large snake, barnacles (*Coronula*), also specimen of land shells (*Bulimus pallidior*, Sby.,) from George Davidson. Skull of Porpoise

(*Lagenorhynchus albirostratus*, Peale,) caught by Captain Marston on a voyage from Tahiti (Lat. 13 deg. N.) to San Francisco, presented by the proprietors of the "Daily Alta California." Specimens of Lizard, Scorpions, Hermit-crab and Cuttle-fish (*Decapod*) from San José del Cabo, by U. S. Consul Gillespie. Branch of Mangrove covered with oysters (*Ostrea conchaphila*) from Magdalena Bay, Lower California, by Samuel Hubbard. Specimen of Deer's head, showing arrested development of the antlers, presented by Mr. C. D. Cleveland, through Dr. Henry Gibbons. Specimens of Sea-mosses (*Algæ*) from San Pedro, presented by Capt. Jos. A. Wilson. Marine Shells from the Shumagin Islands, presented by W. H. Dall. Echinoderms, Gorgonia, etc., from Mazatlan, presented by Henry Edwards.

Prof. Davidson remarked, in connection with the specimens presented by him, that the smaller crustaceans were caught at night in Cape St. Lucas Bay, Lower California, the sea at the time being white with phosphorescence; two individuals of this species would light up a bucket-full of water; the phosphorescence was particularly vivid at each joint of their bodies; the largest specimen, which is of a different species, was taken from the stomach of a *Boneta* caught off the coast of Lower California, in about lat. 23½°. The snake and the land shells were from San José del Cabo, and the specimen of *Coronula* were from the back of a green turtle from Mazatlan.

The following, relating to the deer's head presented by Mr. Cleveland, is taken from a note from that gentleman, which accompanied his gift:

"The specimen I procured two miles from Tejon Pass, San Bernardino county. The deer was killed within a few miles of this locality about one year ago, and on inspection was found to have been castrated, in what manner this was done it is impossible to say. The hunter who killed the animal and from whom I received the specimen asserts that it was an accident of combat. The physiological connection which exists between the testes and the development of the antlers is here * * set forth. * * The deer when killed was thought to be five or six years old. It suffered a rude castration doubtless about the time the horns commenced to grow and" as a result of the injury, "we find the antlers in their present abortive stage of development."

Remarks on the Death of Prof. John Torrey.

BY W. H. DALL.

Prof. John Torrey, well known throughout the world for his attainments in botany and chemistry, the most eminent man of science in New York, and one of the most eminent in America, died in the city of New York on the tenth of March, at the age of seventy-seven.

Born in New York in the year 1796, and connected, from his boyhood to the present time, with all persons or institutions in his native place, whose aims included the advancement of science and learning; his earliest work was the preparation of a flora of Manhattan Island, especially the portion immediately about the suburbs of old New York, a region which he lived to see covered with stately structures of brick and stone.

Taking his medical degree in 1818, he occupied his leisure in the preparation of botanical matter in relation to the Northern States of the Union, east of the the Mississippi River. His publications on this subject, during the six years succeeding, insured him a high rank among the more eminent students of botany.

Shortly after his marriage in 1824, he was called to the professorship of chemistry at West Point; in 1827 he accepted the chair of chemistry and botany in the College of Physicians and Surgeons of New York, and a few years later a similar position at Princeton College. About the year 1853, at the urgent solicitation of the Secretary of the Treasury, he was prevailed upon to take charge of the United States Assay Office, in which he labored up to the time of his death. During this period he was also a trustee of Columbia College, to which the medical school had been annexed, and to him the college owes, beside many years of earnest study and work, the priceless gift of his superb botanical collection and library.

Up to the day before his death he was at his post, signing the daily reports of the Assay Office, and then calmly and peacefully passed away to his rest, so well earned. While devoting his days to chemistry, in which he attained a high rank, thus securing that maintenance for which most scientific students are obliged to struggle so painfully, Botany was the mistress of his heart, to which his leisure and his evenings were devoted, so that it is said that even a few weeks before his death, his light could be seen till nearly midnight in the herbarium of Columbia College.

His writings are to be found in the transactions of nearly every scientific association of America, and among them we may especially enumerate the Report on the plants collected by Dr. James, on Long's Expedition, on the plants collected by Wright in Texas, and by Fremont in California, the Flora of the State of New York, and his unfinished Flora of North America; while his assistance had been secured in the preparation of the Manual of California Botany, now in press by the Geological Survey of this State.

Dr. Torrey twice visited California, once in 1865 and more lately in 1872,

and on both occasions was present at the meetings of this Academy, in whose welfare he took an earnest interest.

While he was most widely known by the published results of his scientific researches, the most precious memory which he has left to those who were fortunate enough to know him personally, is that of a man simple in his tastes and manners, cordial and earnest in his efforts to assist all who might seek his aid or counsel, with the keenest sense of honor and justice, and with a tender, generous and open heart. No man was ever more widely beloved. No man had ever a juster claim to the esteem and affection of all who knew him. He has left behind him an enduring record of faithful, earnest and successful work, and a spotless and honorable name.

Mr. Dall moved that the Chair appoint a committee to draw up suitable resolutions expressing the Academy's sense of the loss which science and humanity have sustained in the death of Dr. Torrey, a copy to be forwarded by the Secretary to the family of the deceased.

Dr. Henry Gibbons also briefly alluded to the estimable character and important services of the deceased, and the loss which science and humanity had sustained by his death.

The president appointed Messrs. Stearns, Dall and John Hewston, Jr., as a committee on resolutions, as suggested by Mr. Dall.

Professor Davidson read a paper giving in detail the results of his examinations for determining the geographical position of the Transit of Venus Station at San José del Cabo, Lower California, occupied by the French Astronomer, M. Chappe d'Auteroche, in 1769.

No information beyond the meagre details given in M. Cassini's account could be obtained in Europe, although personal efforts had been made last season in Paris by Prof. J. E. Hilgard of the Coast Survey. M. Chappe died from a prevailing epidemic soon after observing the transit of Venus, and one of his assistants also died, so that his note books were doubtless defective in detail, and no plans of the building or of the locality have been given in the published account. The evident accuracy of his observations of the phenomenon, and his known skill as an observer, warranted the present undertaking by the Coast Survey to render his results of practical value in the discussion of the sun's parallax.

In Cassini's record it is incidentally mentioned that "the Mission

of San José is situated about one league from the coast, upon a little river which empties into the Vermillion Sea," p. 112; and also that the final latitude adopted, "established very accurately," (although the two determinations differ 31″.5) was 23° 03′ 20″. In the detailed description of mounting the instruments, their position is placed within the walls of a "large granary" from which he removed the roof; and "pedestals of masonry" were erected upon which to place the instruments. The relation of this granary to the church is never referred to, nor when the church was built, its character, or even on which bank of the river.

Upon my arrival at San José del Cabo, in March, I learned there had been no less than four buildings and locations of the church known by the above name, from the erection of the first in 1728 or 1730—for authorities differed even in the date of the foundation. Nor could the dates of the changes be ascertained, as the records of the church had been carried away.

The first was the "Mission Viejo," about five miles from the shore of the bay, and the location of whose site was visited. The present occupant of the house stated that he had found the foundations of the church and granary thirty-five years ago, when he built the present houses. The second was the "Mission," reported near the present cemetery and not half a mile from the bay. The third and fourth locations are identical and in the present town of San José del Cabo, erroneously designated as Salatea on the English charts. (Saláte is the rancho three miles westward of the town.) I was satisfied that neither the first nor second locations was the Transit of Venus Station, both from a study of the ground and the latitudes. From the present priest, an uneducated Indian, but one item of value was gathered; he pointed out the foundations of the third church and the traditional position of the granary always attached or adjacent thereto. Both were much smaller than the present edifice.

Sifting this evidence and studying the topography of the site and the requirements of the problem, I became satisfied that the Venus Station was near the present church. I traced the old foundations to their limit on the north side of the church; but the present church covers the greater part of them. The foundations of the old granary lie to the southeast of the present sacristy, and between it and

the wall, which is twenty-four feet distant and on the line of the street, they have been covered with débris to bring the surface of the ground to the level of the top of the wall. I think it is safe to say that the position of M. Chappe's instruments has been recovered within a space of twenty feet square. This has been referred to the southeast corner of the present church, which was included in the scheme of triangulation to connect it with the astronomical station near the present landing. The "Mission Viejo" and the cemetery were also included in the scheme.

The geographical position of the astronomical station had been been determined under my directions by Mr. W. Eimbeck, of the U. S. Coast Survey, about a fortnight before my arrival. The longitude is determined by the transmission of twenty-four chronometers from and to San Diego, which had been connected with San Francisco by telegraph. The latitude was determined by the zenith telescope method of the Coast Survey.

Thus after an interval of one hundred and four years, we have been able to make available the observations of one who gave his life a sacrifice to scientific pursuits.

Of the position of Velasquez's station for observing the same phenomenon at the "village of Santa Anna, a position which is not placed on the charts," I could gather no clew whatever. In endeavoring to reconcile the two disjointed remarks of Cassini (pp. 43 and 112), it would appear to have been at some rancho on the shores of Ceralvo Bay, about thirty leagues northward and eastward of San José del Cabo, following the coast line.

A search of the archives at Madrid last season had failed to elicit any knowledge of Velasquez's records or report.

Mr. Stearns referred to the valuable and acceptable present of Mr. Hickox as an important acquisition to the Academy's library, and on motion, a special vote of thanks was unanimously tendered to that gentleman for this very handsome gift.

Mr. Gutzkow read the following, describing a new process for the extraction of Boracic acid, and illustrating by a working model the method pursued by him.

A New Process for the Extraction of Boracic Acid.

BY F. GUTZKOW.

I beg to bring to the notice of the Academy a process for the working of Borate of lime, which, besides that I consider it to have some claims as to practicability, presents also some scientific points, which may be sufficiently interesting to some of the members as to warrant me in drawing their attention thereto.

The Academy has already been made aware before of the fact, that in the State of Nevada, lately, large masses of borate of lime have been discovered in different places in Churchill, Esmeralda and other counties. It is interesting, because boracic acid is by no means very profusely distributed on the earth's surface, and borate of lime in particular has, until now, only been found near the celebrated nitrate of soda deposits of Iquiqui in South America. The mineral found in Nevada is the same as the South American. It is not the true borate of lime, but the boronatrocalcite, a combination of borate of soda with borate of lime. An analysis made by myself gave, in round numbers:

42 Boracic acid,
8 Soda,
13 Lime,
37 Water.

There appears to be some difference in the impurities found with it. In Nevada they appear to be principally clay, while in South America gypsum is always more or less found intermixed.

Owing to those impurities, there have been experienced some difficulties in working the mineral in England and France; but still more has the expectation that the South American borate of lime would give a prolific source of borax been reduced by the circumstance, that the shipments from Iquiqui turned out to be of very unequal nature as to quality, which with the difficulty of ascertaining the true proportion of boracic acid by an easy assay, rather demoralized the market for the substance in question.

In this country the process used for working it consists in a kind of concentrating operation, by which, with an enormous loss in substance, the borate of lime is freed from the impurities. Then it is boiled with a solution of carbonate of soda, and the solutions obtained worked for a crude borax, to be refined afterward by recrystallization. This process has several important drawbacks. In the first place, the high price of soda on this coast interferes seriously. Although the State of Nevada possesses large deposits of crude soda, it becomes so dear by the high cost of transportation, that in this city it is about as advantageous to employ the English sal-soda, which is, besides, a much purer article. Furthermore, the decomposition of the borate of lime is not complete by soda, and the residue will always contain some undecomposed mineral, unless a very large quantity of water is used. As the borate of lime is not insoluble in water, it is possible to extract by water alone all traces of the mineral; but on

the large scale this is, of course, not feasible. In the third place, the clay mixed with the mineral, and the carbonate of lime formed by the soda, make the residue extremely bulky. It takes a long time to make it settle into a pulp of some reasonable thickness; therefore several washings are required to wash the absorbed borax-solution out, thus yielding weak solutions which have to be worked up and concentrated.

In view of these facts I thought it advisable to devise a better process than the one described.

My process is based upon the volatilization of boracic acid by water vapors; a fact which nature itself proves, by furnishing in that way all the boracic acid manufactured in Tuscany. But by my own experiments I discovered that that volatilization can be made complete, that is, that a given quantity of boracic acid can be completely volatilized by steam alone.

The plainest experiment which laid the foundation to my process is this: To melt in a platinum crucible some boracic acid into a glass, weigh the crucible with contents, and conduct steam by a brass tube into the crucible while the latter is heated to redness. By weighing from time to time, the progress of volatilization may be observed. After two hours continuing the experiment, more or less, the crucible will be found entirely empty. Other experiments by which I suspended a weighed platinum wire, on to which a pearl of boracic acid was molten, in an iron gas-pipe, and conducted steam of different temperature through that apparatus, showed that the speed of the volatilization is entirely depending on the temperature of the steam. Steam of 212° F., is not capable of removing more than traces, unless the reaction is allowed to continue for a very long time. If the gas pipe surrounding the boracic acid pearl is however, heated to redness, the volatilization is most rapid.

The rather surprising fact that the steam of 212° F. has so little power for the purpose, caused me to experiment on some statements made by Henry Rose, the celebrated chemist to whom we are mostly indebted for our knowledge of the element *Boron* and its combinations. Rose states that it is not possible to concentrate a solution containing free boracic acid without loss of substance. I found this correct when the solution is evaporated in an open dish, but not so when the concentration takes place in a glass flask. On concentrating a quite concentrated solution of boracic acid in a glass flask over a moderate fire, I never could condense more boracic acid than the mechanical carrying off by the vapors would account for, that is a trace. In an open dish, however, in the progress of concentration, a ring of boracic acid separated on the dish, which boracic acid is heated much more than the solution and is exposed to the action of the steam rising from the liquid. In that case a volatilization takes place.

Having found out that superheated steam is much more powerful in carrying off boracic acid than steam of 212° F., it was easy to conclude that the condensation of the volatilized boracic acid could not present great difficulties. The boracic acid volatilized in the apparatus described before, that is, in a heated iron pipe, was found condensed in the colder portion of the pipe. By regulating the length and temperature of the pipe, the fact resulted that the steam could be deprived nearly entirely of its percentage in boracic acid.

From these facts the following process of working borate of lime suggested itself:

The borate of lime can be used as found on the borax marshes, or more or less purified if it has to be transported some distance. It is placed into a lead-lined, shallow pan, covered with half the weight of water, and allowed to stand for a day, or longer, in order to allow the lumps to dissolve. Then from one-quarter to one-half the weight of sulphuric acid is added and the whole well stirred into a stiff pulp, which is taken out and thrown in a heap. After some days the mess has become hard, as the gypsum formed commences to set. With this first operation the mass is ready for the second operation—the distilling with steam. It is done in an iron retort with an arrangement for heating it. An ordinary gas pipe, 12 feet by $1\frac{1}{2}$ feet, would answer very well. It ought to stand in an upright position, in order to facilitate the charging and discharging, as also to cause an equal action of the steam. When the pipe is sufficiently heated that no condensation of steam can take place, steam is admitted. It becomes superheated within the retort and carries along the boracic acid, leaving a porous mass of gypsum, etc., which, when the operation is continued sufficiently long, will be found entirely free from boracic acid. It has been mentioned before that the rapidity of the action depends only on the heat employed. If the temperature of the retort is near the red heat, from one to two hours will suffice to finish the operation in the lower part of the retort. At a temperature of only say 400° F., which is very easily reached within the retort, about four hours will be required.

The details of the apparatus which allows a continuous working, and by withdrawing only half the contents every few hours, allows the mass to be exposed twice as long, that is eight hours, to the action of the steam, I will omit here.

The steam which leaves the retort is highly charged with boracic acid. It can be made to absorb not less than the fourth part of its weight of the hydrated boracic acid. From the retort it passes into a brick or lead-lined wooden chamber where most of the hydrate of boracic acid will deposit. Thence it passes another chamber, or better, a long flue provided with some metal grating, before it escapes into the atmosphere. Also a worm condenser can be used, and with it a strong solution of boracic acid will result. It may also pass through a coil of lead or other metal, which utilizes the waste heat. There are numerous devices to remove, by partial condensing, the last traces of boracic acid if desired.

Most of the boracic acid is, however, found in the first chamber, as hydrate. $BO_3 + 3\,HO$, and can be from time to time removed. It can be easily melted into a glass, taking care to condense the fumes during melting, and is then absolutely pure. In the state as found in the chamber, it may contain a little sulphuric acid, but by admixture of some coke or charcoal with the top layer in the retort, the sulphurous acid can be entirely converted into sulphurous gas, which escapes uncondensed from the chambers. There is no other substance present to interfere with the purity of the product obtained. In a mechanical way nothing can go over, as the mass within the retort gets all glazed over by boracic acid.

The advantages of the process are, that with very little labor in one single and short operation, the mineral can be exhausted. There are no rich residues left to be worked over nor liquors to be concentrated, which makes the lixiviating process so complicated. Besides, the boracic acid, and particularly the boracic acid glass, can bear the high cost of transportation from the borax marshes much better than the borax or the borate of lime. To bring one pound of borax from the marshes to the market, that is, New York or European ports, costs now from six to seven cents. To transport the molten boracic acid, which gives three pounds of borax nearly, would reduce the cost for one pound of borax by two-thirds.

Regular Meeting, April 21, 1873.

President in the Chair.

Forty members present.

J. B. Cox, Frank F. Taylor, Charles B. Brigham and D. S. Hutchinson were elected resident members.

The name of Mr. S. B. Boswell, elected resident member on the sixth of January, was transferred to the list of life members, he having paid the required fee.

Donations to Library: Proceedings of Agassiz Institute, pp. 25–48. Overland Monthly, May, 1873. Bacon & Company presented a Hand-stamp.

Donations to Museum: Fossil shells from Santa Rosa Island by W. G. Blunt. Tooth of Elephás from Scalchet Head, Puget Sound, also Elk horn wedge from same place, found near the preceding specimen, at the foot of a bluff 250 feet high, presented by J. S. Lawson of U. S. Coast Survey. Fossil mollusks from near Mount St. Helena, by Col. C. L. Bulkeley. Egg of a species of Fish, probably allied to the Rays, from Newport Bay, fourteen miles south of Anaheim, presented by Dr. David Taylor. Portion of tooth of Elephas, supposed to have been found near Sitka, from L. W. Ransom. Specimen of saw of saw-fish from west coast of Mexico, presented by Adolph Hartman, through Mr. A. Cooper. Tooth of fossil Elephas from Santa Barbara Island, by W. G. Blunt. Fossil barnacles, found at foot of gravel bluff, forming west bank of Salinas River, in T. 21 S., R. 9 E., about sixty miles south of Salinas City, County of Monterey, from Michael Deering.

Notes on the Honey-Making Ant of Texas and New Mexico, Myrmecocystus Mexicanus of Westwood.

BY HENRY EDWARDS.

The natural history of this very curious species is so little known, that the preservation of every fact connected with its economy becomes a matter of considerable scientific importance, and the following observations, gleaned from Capt. W. B. Fleeson of this city, who has recently had an opportunity of studying the ants in their native haunts, may, it is hoped, be not without interest.

The community appears to consist of three distinct kinds of ants, probably of two separate genera, whose offices in the general order of the nest would seem to be entirely apart from each other, and who perform the labor allotted to them without the least encroachment upon the duties of their fellows. The larger number of individuals consists of yellow worker ants of two kinds, one of which of a pale golden yellow color, about one-third of an inch in length, acts as nurses and feeders of the honey-making kind, who do not quit the interior of the nest, "their sole purpose being, apparently, to elaborate a kind of honey, which they are said to discharge into prepared receptacles, and which constitutes the food of the entire population. In these honey-secreting workers the abdomen is distended into a large, globose, bladder-like form, about the size of a pea." The third variety of ant is much larger, black in color, and with very formidable mandibles. For the purpose of better understanding the doings of this strange community, we will designate them as follows:

No. 1—Yellow workers; nurses and feeders.

No. 2—Yellow workers; honey makers.

No. 3—Black workers; guards and purveyors.

The site chosen for the nest is usually some sandy soil in the neighborhood of shrubs and flowers, and the space occupied is about from four to five feet square. Unlike the nests of most other ants, however, the surface of the soil is usually undisturbed, and but for the presence of the insects themselves, presents a very different appearance from the ordinary communities, the ground having been subject to no disturbance, and not pulverized and rendered loose as is the case with the majority of species.

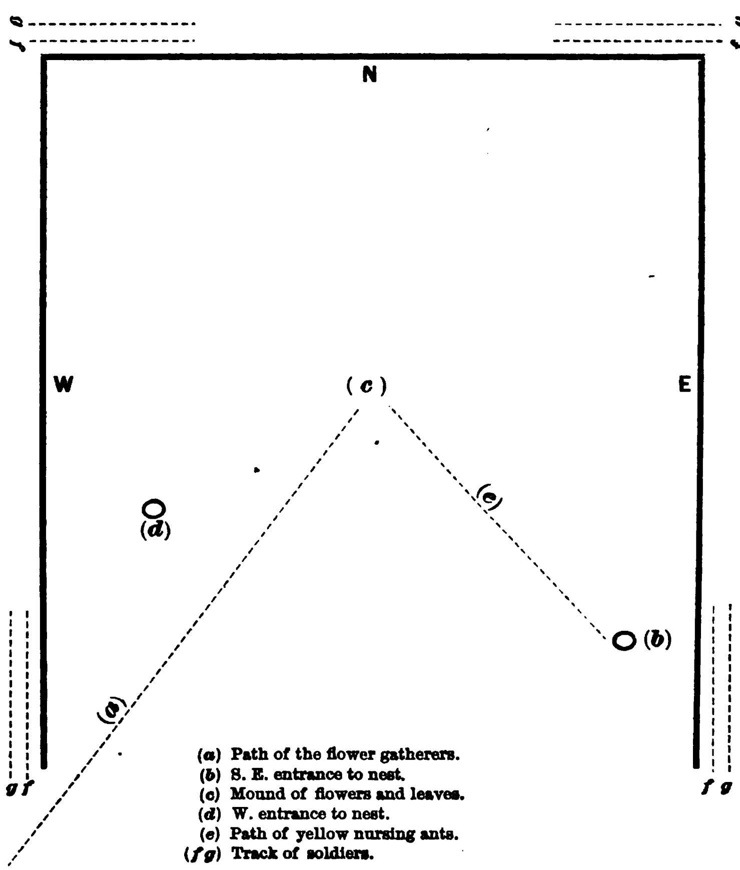
The black workers (No. 3) surround the nest as guards or sentinels, and are always in a state of great activity. They form two lines of defence, moving different ways, their march always being along three sides of a square, one column moving from the SE to the SW corners of the fortification, while the other proceeds in the opposite direction. In most of the nests examined by Captain Fleeson, the direction of the nest was usually towards the north; the east, west and northern sides being surrounded by the soldiers, while the southern portion was left open and undefended. In case of any enemy approaching the encampment, a number of the guards leave their station in the line and sally forth to

face the intruder, raising themselves upon their hind tarsi, and moving their somewhat formidable mandibles to and fro as if in defiance of their foe. Spiders, wasps, beetles and other insects are, if they come too near to the hive, attacked by them in the most merciless manner, and the dead body of the vanquished is speedily removed from the neighborhood of the nest, the conquerers marching back to resume their places in the line of defence, their object in the destruction of other insects being the protection of their encampment, and not the obtaining of food. While one section of the black workers is thus engaged as sentinels, another and still more numerous division will be found busily employed in entering the quadrangle by a diagonal line bearing NE, and carrying in their mouths flowers and fragments of aromatic leaves which they deposit in the centre of the square. A reference to the accompanying sketch will give a more clear understanding of their course; the dotted line (a) representing the path of this latter section, while the mound of flowers and leaves is marked (c). If the line (a) be followed in a SW direction, it will be found to lead to the trees and shrubs upon which another division of the black workers is settled, engaged in biting off the petals and leaves to be collected and conveyed to the nest by their assistants below. On the west side of the encampment is a hole marked (d), leading down to the interior of the nest, which is probably chiefly intended for the introduction of air, as in case of any individuals carrying their loads into it, they immediately emerge and bear them to the common heap, as if conscious of having been guilty of an error. A smaller hole near to the SE corner of the square, is the only other means by which the interior can be reached, and down this aperture, marked (b), the flowers gathered by the black workers are carried along the line (e), from the heap in the centre of the square, by a number of the smaller yellow workers (No. 1), who, with their weaker frames and less developed mouth organs, seem adapted for the gentler offices of nurses for the colony within. It is remarkable that no black ant is ever seen upon the line (e), and no yellow one ever approaches the line (a), each keeping his own separate station and following his given line of duty with a steadfastness which is as wonderful as it is admirable. By removing the soil to a depth of about three feet, and tracing the course of the galleries from the entrances (b) and (d), a small excavation is reached, across which is spread in the form of a spider's web, a net work of squares spun by the insects, the squares being about one-quarter inch across, and the ends of the web fastened firmly to the earth of the sides of the hollowed space which forms the bottom of the excavation. In each one of the squares, supported by the web, sits one of the honey-making workers, (No. 2), apparently in the condition of a prisoner, as it does not appear that these creatures ever quit the nest. Indeed it would be difficult for them to do so, as their abdomens are so swollen out by the honey which they contain, as to render locomotion a task of difficulty, if not to make it utterly impossible.

The workers, (No. 1), provide them with a constant supply of flowers and pollen, which, by a process analogous to that of the bee, they convert into honey.

The fact that the remainder of the inhabitants feed on the supply thus obtained, though it is surmised, has not been established by actual observation : indeed, with reference to many of the habits of these creatures, we are at present left in total ignorance, it being a reasonable supposition that, in insects so remarkable in many of their habits, other interesting facts have yet to be brought to light respecting them. It would be of great value to learn the specific rank of the black workers (No. 3), and to know the sexes of the species forming the community, their season and manner of pairing, and whether the honey-makers are themselves used as food, or if they excrete their saccharine fluid for the benefit

DIAGRAM OF THE EXTERIOR OF THE NEST OF MYRMECOCYSTUS MEXICANUS.



of the inhabitants in general, and then proceed to distil more. I regret that at this time I am only able to bring before the notice of the Academy, specimens of the honey-makers (No. 2), the other members of the community, except from Captain Fleeson's description, being quite unknown to me. It is, however, my hope that at a future meeting I may be enabled to exhibit the other varieties, and to give some more extended information upon this very interesting subject. The honey is much sought after by the Mexicans, who not only use it as a delicate article of food, but apply it to bruised and swollen limbs, ascribing to it great healing properties. The species is said to be very abundant in the neighbourhood of Santa Fé, New Mexico, in which district the observations of Capt. Fleeson were made.

On the connection between the Atomic Weights of Substances and their Physiological Action.

BY JAMES BLAKE, M. D.

In a communication to the Academy of Sciences, of France, read February 10th, Messrs. Rabuteau and Ducondray state that the poisonous effects of metals is greater as their atomic weights increase. Having been engaged for many years in experimenting on the physiological effects of organic compounds, I find myself in possession of a number of facts bearing directly on this interesting question. In a paper read before the Royal Society of England in 1841, I stated that isomorphous substances, when introduced directly into the blood, produce analogous physiological reactions. Since this time a widely extended series of experiments with these substances has confirmed the truth of this fact.*

I shall not now enter into a general review of the facts I have already published, but would state that when the different elements are grouped according to their isomorphous relations, I find, evidently, a close connection between their physiological action and relative atomic weights, and it is only with this restriction that the statement of Messrs. Rabuteau and Ducondray is even approximately applicable. That no absolute connection exists between the atomic weight of a metal and its physiological action, is evident. For instance, the salts of potassium, the atomic weight of which is thirty-nine, are far more poisonous than the salts of ferrous oxide, the atomic weight of iron being 56, and the salts of beryllium with an atomic weight of 9.3 are more poisonous than the salts of silver, with an atomic weight of 108. As an example of the connection between the atomic weights and the poisonous qualities of a substance, the accompanying table affords strong evidence that such a connection exists when the substances belong to the same isomorphous group. The experiments were performed on rabbits, by injecting solutions of some salt of the metal directly into the jugular vein.

* An account of many of these experiments is contained in the Reports of the British Association for the Advancement of Science, from 1845 to 1850, and in 3d, 4th and 5th vols. of the *Journal of Anatomy and Physiology*.

NAME OF SUBSTANCE.	ATOMIC WEIGHT.	QUANTITY FATAL.
Lithium	7	40 grs.
Sodium	23	20 grs.
Rubidium	65	6 grs.
Cæsium	133	9 grs.
Thalium	204	3 grs.

These substances all belong to the same isomorphous group, their distinctive physiological action being that they are all lung poisons, as they kill by the action they exert on the lungs, either by suddenly arresting the pulmonary circulation or by causing changes in the lung tissue which prevent the aeration of the blood. Having experimentally investigated the physiological action of most of the more important groups of inorganic compounds, comprising about forty of the different elements, I would bring forward a large amount of evidence, showing that to a certain extent a connection exists between the relative atomic weight of substances in the same isomorphous group and their physiological action, and this I propose to do on some future occasion. At present I will cite one more striking example furnished by the salts of iron. This metal, as is well known, furnishes two classes of salts, in one of which the molecule is bivalent, the atomic number being 56, in the other class the molecule becomes quadrivalent, with a combining number of 112. Of the former class of salts, 30 or 40 grains can be introduced into the veins (in dogs) without destroying life, whilst 3 or 4 grains of the quadrivalent compounds are fatal. The extremely poisonous effects of the metals of the platinum group with their high atomic weight, is another instance of the connection of atomic weight with physiological action. The above observations tend to confirm an opinion I expressed in a paper read at the meeting of the British Association for the Advancement of Science, in 1845, when I stated: "In considering the action of inorganic compounds on living beings, it is clear that our attention must not be directed exclusively to the chemical properties of these substances; it must not be as acids or alkalies or salts that their action on living beings must be investigated, but as regards their isomorphous relations, or those properties which are evidently connected with the form they assume."

In our ordinary chemical reactions, the greater the atomic weight of a body the larger the quantity that must be used to form the different compounds into which it enters; whilst the above facts show that with certain restrictions the very reverse of this is the case in the reactions it produces in living beings. The above facts, together with those already published, justify the conclusion that, first: when introduced directly into the blood, each member of an isomorphous group gives rise to analogous reactions, both on the tissues and on the blood, and second: that the intensity of these reactions is in some way connected with the relative atomic weight of the substance in the group to which it belongs. Exceptions undoubtedly present themselves to the above generalizations, nor is it at all surprising that in the present imperfect state of our knowledge as regards atomic physics, that such should be the case; but still, the number of instances in which a well marked connection is found between isomorphism,

atomic weight and physiological action, is so large, that that there can be no doubt that these molecular properties of inorganic elements are closely connected with their physiological action.*

Mr. Stearns, after describing the general characteristics of the Nudibranchiata, submitted the following.

Descriptions of a New Genus and two New Species of Nudibranchiate Mollusks from the Coast of California.

BY ROBERT E. C. STEARNS.

Genus LATERIBRANCHIÆA, Stearns.

Animal like *Triopa*, with a single series of gills on each side, central or subcentral and opposite.

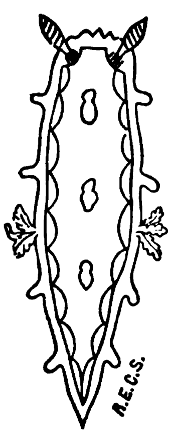


FIG. 1, ($\frac{2}{1}$).

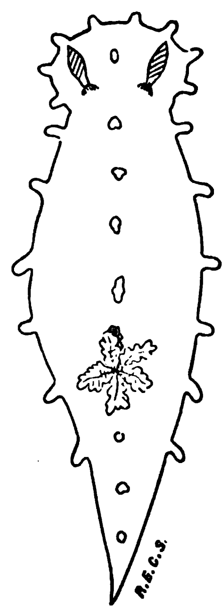


FIG. 2, $\frac{2}{1}$).

LATERIBRANCHIÆA FESTIVA, Stearns, FIG. 1.

Body slug-shaped, about one inch long; of a *translucent* cream white color on back, ornamented with looped linear markings on each side, of an opaque *chalky*

*NOTE.—In these experiments which were conducted to ascertain the general effects of the substances used, the quantities employed were usually injected in four or five doses, and therefore do not probably indicate the minimum doses that would be fatal.

white, and three irregular, ring-shaped markings of the same color, nearly equidistant and along a central line on the back, also marked with a few inconspicuous irregularly placed orange spots; cephalic tentacles short, clavate, stumpy, fringed at base, branchial orifices on each side, sub-central, with short arborescent plumes.

Habitat.—Point Pinos, near light house, Monterey, California, on the under side of granite boulders at extreme low tide; detected by Mr. Harford and myself in March, 1868.

TRIOPIDÆ, Gray.

TRIOPA, Johnston.

TRIOPA CARPENTERI, Stearns, FIG. 2.

Animal slug-shaped; anteriorly obtusely rounded, posteriorly pointed, somewhat attenuated; cephalic tentacles clavate, upper part of same of an orange color, below white; gill plumes five, arborescent, resembling fern leaves, tipped with orange; plumes and tentacles 1-16 inch in length; the former situated in middle of the back somewhat posterior to centre. Six tentacular processes on each side, tipped with orange and 1-32 inch long; also short tentacular processes in front of the head; body one and one-half inches in length, translucent white, covered with fine papillæ of an orange color.

Habitat.—Monterey, at Point Pinos near the light house, on the under side of granite rocks at edge of laminarian zone, where the above was collected by Mr. W. G. W. Harford and myself in March, 1868.

This species is named for my friend Dr. P. P. Carpenter of Montreal, whose thorough work in connection with the mollusca of W. North America has been of great service to investigators.

The above descriptions, though somewhat meagre from lack of the proper instruments for more careful diagnosis, are nevertheless adequate to a ready determination of both of the above well marked and elegant species.

Descriptions of New Marine Mollusks from the West Coast of North America.

BY ROBERT E. C. STEARNS.

CONUS DALLI, Stearns. Plate I, fig. 1.

Shell conical, robust with a smooth surface faintly marked with incremental lines; lower third portion of shell obscurely spirally ribbed and the spire elevated and indistinctly grooved on the top of each whorl; body whorl and spire moderately convex, the latter with a distinct sutural line and a faint sulcation parallel to the same; outer lip simple, aperture linear, internally of a delicate rose-pink tinge; surface of shell marked with irregular longitudinal stripes of reddish brown and sienna yellow, the former color predominating and blending in more or less and glazing the yellow; the longitudinal markings are interrupted by a series of four revolving bands (of which the two lowest are the widest,) composed of numerous whitish spots of irregular size and shape but generally small, rounded or angular; occasionally whitish subangulate spots of larger size

than those included in the bands occur between the same, and in line with the longitudinal markings.

Dimensions of largest: Long. 2.35; lat. 1.22 inches. Another specimen measures: Long. 2.15; lat. 1.1 inches.

Habitat.—Gulf of California, from whence specimens are occasionally brought to San Francisco on vessels in the Gulf trade. It is not common.

Figure 70 in Sowby's Conch. Illustr. without habitat, and named "C. textile var." resembles this species. Specimens are in my collection and in that of Mr. Fisher of San Francisco.

This shell belongs to the group of so-called "embroidered cones" of which *C. textile* is the most common illustration, and it might carelessly be mistaken for that species; in *C. textile* however the white (in cleaned specimens) is the dominant color, and the triangular blotches of white are large and sharply defined by a line of brown, and there is but little blending or coalescing of the brown and yellow lines, which are much sharper and more distinct as well as of a lighter shade and narrower than in *C. Dalli*. *C. textile* is of a clear whiteness interiorly, while the shell described herein has a delicate pinkish interior; in *textile* the spire is somewhat *concave*, in *Dalli* it is moderately *convex;* and the latter in outline is a less graceful shell, and belongs to a widely separated zoölogical province.

PTYCHATRACTUS OCCIDENTALIS, Stearns.

P. occidentalis, Stearns, Prel. Descr. August 28, 1871.

Shell elongated, fusiform, rather slender, whitish, traversed by narrow, revolving, brownish threads and much wider intervening spaces; suture distinct, spire tapering; aperture oblong-oval, about half the length of the shell; within white, polished; canal short, nearly straight; columellar obliquely, not strongly plicated; length about three-fourths of an inch.

Habitat.—Near the Island of Nagai, one of the Shumagin Islands, where it was hooked up attached to a rock from a depth of forty fathoms, by Captain Prime of the California Fishing fleet; through the kindness of Mr. Harford to whom it was given, it is now in my cabinet.

This shell in its general features resembles the North Atlantic *P. ligatus* of Mighel and Adams, *vide* Boston Jour. Natl. Hist., IV, 1842, p. 51, pl. IV., fig. 17. It is a more delicate shell than the Atlantic species, though my solitary specimen, judging by the thinness of the outer lip, is not quite mature. I regret that I am unable at present to furnish figures of this and the succeeding species, the specimens having inadvertently been mislaid.

FUSUS (CHRYSODOMUS?) HARFORDII, Stearns.

F. (*C.*) *Harfordii*, Stearns, Prel. Descr. August 28, 1871.

Shell solid, elongate, regularly fusiform; spire elevated, whorls six or seven, moderately convex, slightly flattened (in outline) above, with a groove or channel following the suture; color, chocolate brown; surface marked by numerous narrow revolving costæ, which alternate in prominence on the body whorl, and longitudinally by fine incremental striæ, and on the upper whorls by obtusely

rounded ribs of more or less prominence; aperture ovate, about one-half the length of the shell, polished, white and finely ribbed within; (the outer lip in perfect specimens is probably finely crenulated); canal short, nearly straight. Lon. 2.1; lat. .94 in. Number of specimens, three; two mature, dead, one junior, fresh.

Habitat.—Coast of Mendocino County, near Big Spanish Flat, California, where it was detected by Mr. Harford.

Though almost typically fusiform, except in the brevity of the canal, I am disposed to place it in *Chrysodomus* rather than with *Fusus*. Dr. Carpenter is inclined to believe that certain specimens collected at Monterey by the late Dr. C. A. Canfield and at Catalina Island by Dr. Cooper, are identical with the above. I am of the opinion that it is rather a northern form, exceedingly local in its distribution and more nearly allied to some of the later fossils of the coast described by Mr. Gabb.

PLEUROTOMA (DRILLIA) MONTEREYENSIS, Stearns. Plate I, fig. 2.

P. (*D.*) *Montereyensis*, Stearns. Prel. Descr. August 28, 1871.

Shell small, rather solid, elongate, slender; spire elevated, sub-acute; whorls, seven to eight moderately rounded; upper portion of larger volutions somewhat concavely angulated; suture distinct; color, dark purplish brown or black; surface covered with rather coarse, inconspicuous, revolving costæ, interrupted on the body whorl by rude incremental lines; middle of upper whorls and upper part of body whorl displaying fourteen to fifteen equidistant, longitudinal, nodose, slightly oblique ribs, which are whitish in the specimen before me (being somewhat rubbed) on the larger whorls; on the smaller volutions of the spire a puckering at and following the suture suggests a second indistinct series of nodules; aperture less than half the length of the shell; canal short; terminal portion of columella whitish, slightly twisted; posterior sinus, rather broad rounded, and of moderate depth. Long. .67 in.; lat. .24 in.

Habitat.—Monterey, California, where the single specimen in my cabinet was collected by Mr. Harford and myself in March, 1868. The shell, in its general aspect, resembles the sombre colored species of the Gulf of California and Panama.

In the cabinet of the Rev. J. Rowell is a specimen perhaps of this species, but not in sufficiently perfect condition to admit of certainty.

PLEUROTOMA (DRILLIA) HEMPHILLII, Stearns. Plate I, fig. 3.

P. (*D.*) *Hemphillii*, Stearns, Prel. Descr. August 28, 1871.

Shell small, smooth, slender, polished; spire long, subacute, rounded at apex; longitudinally marked with inconspicuous, oblique ribs, which are nearly obsolete on the body whorl; number of whorls seven, with well defined sutural line, and just below it a parallel impressed thread-like line; shell of an opaque dingy horn color; incremental lines fine, marked in some specimens with dingy white; mouth obliquely ovate, about one-third the length of the shell; labrum produced, anteriorly somewhat thickened; sinus sutural, deep, calloused; columella thickened at base; canal very short, somewhat produced and twisted; one spec-

imen shows obscure, revolving, impressed lines below the swell of the body whorl; size quite uniform. Long. .26; lat. .09 inch.

Habitat.—Todos los Santos Bay, Lower California, where several specimens were obtained by Mr. Hemphill, for whom I have named this well marked species.

MURICIDEA SUBANGULATA, Stearns. Plate I, fig. 4.

Shell small, abbreviated fusiform, dingy white and marked spirally by an inconspicuous band formed of three reddish-brown lines more or less interrupted on the basal and the preceding volution; whorls five, angulated above and on the basal whorl rounded below the angle, with a shallow sulcation beneath; surface covered with rounded and irregular costæ, which are inconspicuous or obsolete on the upper whorls; longitudinally marked with from seven to nine irregular rounded ribs, which at the edge of the angle (which is somewhat carinated) are broken into angular or pointed knobs or blunt spines; aperture ovate, angulated above and white within; the outer lip with five or six tubercles internally; canal moderately prolonged, slightly curved and open in the two specimens before me. Dimensions of largest: Long. .89; lat. .41 inch.

Habitat.—San Miguel Island, off the southern coast of California, where the specimens from which this description is made were obtained by Mr. W. G. W. Harford.

ASTYRIS VARIEGATA, Stearns. Plate I, fig. 5.

Shell small, elongated, acutely conic, light rufous-brown or sienna-yellow under a thin brownish or greenish epidermis; with whitish median and sutural bands more or less interrupted; in some specimens these bands are connected by waved lines of a darker brown; surface of shell when free from epidermis, smooth and shining, marked with delicate incremental lines, and on the lower portion of the body whorl with narrow grooves; apex rounded, whorls seven, convex; suture well defined, aperture ovate, about one-third the length of the shell; outer lip simple, in some specimens a little thickened with small tubercles on the inner side.

Dimensions: Long. .3; lat. .12 inch.

Habitat.—San Diego, California, where numerous specimens were collected by Henry Hemphill, Esq. This beautiful species resembles some forms of *Nitidella* and *Truncaria;* it differs from *Astyris tuberosa*, in the greater convexity of the whorls, and especially in being without the angularity or concavity which is displayed in the lower part of the body whorl in the latter species; it is a more delicate and graceful shell than either of the other forms of *Astyris* found on the coast, many of which have been distributed as "*Amycla*" or "*Columbella*" *gausapata, Californiana, carinata,* and var. *Hindsii.*

PHOLAS PACIFICA, Stearns. Plate I, figs. 6, 6a, 6b, 6c.

P. Pacifica, Stearns, Prel. Descr. August 28, 1871.

Shell oblong, beaks two-fifths of length of shell from anterior end; anterior end of valves triangular, pointed; anterior dorsal edge of valves reflected and folded

down on the umbos; lower anterior margin curved, forming a large elliptic-oval gape; posteri r end of valves squarely rounded; shell dull chalky white, sculptured in concentric lines, which anteriorly are laminated and posteriorly become extinct; valves radiately ribbed, which also become obsolete at the posterior end; at the intersection of the radiating and concentric lines the sculpture is pectinated; an area below the umbos nearly or quite destitute of sculpture, which varies much in prominence in different specimens; accessory plate sub-lanceolate and bent down on the beaks, anteriorly prolonged, but not wholly covering the ante-umbonal gape; figs. 6a, 6b, show the variation in the shape of the dorsal plate in different specimens; interior of valves white, enamelled; internal rib short, curved and flattened. Largest specimen, two and six-tenths inches in length, and one and five-tenths inches in height.

Habitat.—Alameda, San Francisco Bay, California, where in some places it is common in sandy mud between tide marks. Numerous specimens collected by Messrs. Harford, Hemphill, Drs. Kellogg and W. P. Gibbons.

This shell is the West Coast analogue of the Atlantic *P. truncata*, Say, which it resembles; it is however a much longer shell for its width, and the portion of the valves posterior to the beaks, very much longer than in Say's species. Specimens of this species have been distributed as *Zirphæa crispata*, which also is found upon the coast, though quite distinct from *P. Pacifica*, which latter comes within Mr. Tryon's subgenus *Cyrtopleura*.

According to the Messrs. Adams in the genus *Pholas*, there are *two* dorsal plates; yet they have included in their list of the species under that genus, *P. truncata*, Say, which has only *one*.

Dr. Kellogg read a description of a new species of native cotton found by Professor Davidson at San José del Cabo, Lower California, lat. 23° 3′, a plant about four or five feet high, flowers bright straw yellow with purple centre, fruit not seen, and which may be called *Gossypium Davidsonii*, Kellogg. Also a new species of *Convolvulaceæ* or Golden Morning Glory, *Aniseia aurea*, Kellogg; a beautiful perennial twining vine, collected at the same locality with the preceding by Prof. Davidson in March, 1873.

Descriptions of New Plants from the West Coast of America.

BY A. KELLOGG, M. D.

Gossypium Davidsonii, Kellogg.

On the branches bark cinnamon brown, puberulent and sparsely stellate throughout, the extremities villous or short hirsute and somewhat stellate, with black spots and dark glands intermixed on twigs, petioles, leaves, peduncles and floral envelopes and flowers; upper leaves roundish-cordate, entire, or sub-entire, (or with an occasional tooth, indicative of a pseudo 2 to 3-lobed disposition), acute, or abruptly acuminate, 5-palmate-nerved, densely velvety hirsute on both surfaces; a single oval gland on the mid-rib beneath, petioles short (about half

the length of the blade). Peduncles short, not articulated, bracts minute, linear, opposite at the base of junction with the stem, early deciduous.

Involucels 3-leaved, somewhat unequal, cordate, acute, cleft-dentate (7 to 10 teeth) or cleft-lobed towards the apex, 7-nerved or more; (½ to ¾ inch long and ½ inch wide), calyx cup-shaped, border repand-dentate or sub-5-toothed, dotted throughout with black glands mostly in parallel longitudinal lines, hirsute in lines (about 20) along the minute and somewhat obscure ridges, lobes of the style 3, coherent, stamens about midway below the stigmas.

Flowers bright lemon yellow, with a purple spot at the base of each petal, petals oblique, purplish tinged on the outer margin above (owing to exposure in the convolute state of æstivation), flower about 1½ inches or so in expansion. Petals hirsute on the back, chiefly at the outer exposed margin and edge. Capsules not seen—and the specimen too fragmentary for fuller description.

Closely allied to the Java cotton tree—a shrub about 5 feet high (*G. Javanicum*=a *sida* of some authors); but that is "quite smooth," besides the long peduncles, etc.

This closely approximates the Nankeen cotton of India or China, but this—the *Gossypium religiosum*—the sacred or religious cotton, differs from the *Davidsonii* in having 3 to 5-lobed leaves, and white flowers, instead of yellow and purple spotted—as the plant before us.

In the absence of capsules and seeds, with only a single flower for external inspection; a question might arise whether this may not prove another species of the new genus *Thurberia* of Gray. It may be proper to say, the plant upon which that genus is founded is evidently of the tribe *Hibisceæ*, having the peduncle articulated in the middle, which is not the case with this—of minor specific import is its glabrous character—narrowly lanceolate entire involucels, of barely 3 or 4 lines in length, or twice the length of the cup-shaped truncate entire calyx, etc., hence we see no reason, as yet, for separating it from *Gossypium* as indicated.

I take great satisfaction in dedicating this plant to the worthy President of the Academy, as an act of justice to the discoverer, and in consideration of his zeal to promote the cause of science by every opportunity and means in his power. These evidences are well known and multiply—and are, we trust, duly appreciated—our admiration is enhanced by a knowledge of his arduous official duties, sufficient to excuse any one from further cares, who was less devoted to the cause of science.

Aniseia aurea, Kellogg.

Stem perennial herbaceous twining, (from right to left, or against the sun); somewhat pentagonally striate, subglabrous, or slightly puberulent, (scarcely a few scattering hairs); leaves alternate super-pedunculate, or the axils reversed, quinate-digitate, leaflets rhombic (rarely obovate) entire, subrepand, apex mucronate or sub-cuspidate, sessile or subsessile, long (½ to 1 inch, or twice the length of the petiole, which is persistent while the leaflets are deciduous), subglabrous above, slightly rugose-pitted beneath, somewhat lighter green, and of rather unequal size.

Peduncles sub-axillary (by reversion ?), about equal the petioles, but stouter, articulated with the pedicel close below the flower, 2 or 3 very minute bracts or scales at or near the articulation; calyx of 5 or 6 unequal sepals, outer lower (¼ shorter than the 3 succeeding) sub-cordate-carinate at the base, flattened membranaceous above to the scarious mostly entire margin, oval-oblong, obtuse, sometimes apiculate, notched; the three succeeding a little broader and longer, more oval, inserted higher; the fifth scale or lobe narrower; the sixth inmost highest scale, hyaline, acute from a broad base, short (about ¼ of an inch long, or ¼ to ⅓ the length of the outer sepals).

Flowers large, (3 inches or more in expansion) golden yellow, 5 broad strap-like bands of about equal width radiate the widely expanding funnel-form flower corolla, each band 5-nerved, the bell-shaped throat rather abruptly narrowed into a short purple tube; stamens 5, sub-equal, short, somewhat unequal filaments (purple almost to black) subulate, glabrous above, bearded at the extreme base, about half the length of the (yellow) anthers, which are fixed by the sub-cordate-hastate base, introrse oblong gradually attenuate above, in the dry state twisted from left to right or contrary to the stem; style short, glabrous (purple), stigma 2-lobed, stigmatic-lobes cerebriform-folded; capsule with an annulate base, 2-celled, cells 2-seeded, seeds sub-angular or rounded on the back with two flatish faces, glabrous.

Occasionally a small scale a little below and apart from the proper calyx is seen, not included in the six segments enumerated. A plant perhaps nearest allied to *Spomæa quinata*, Br., a New Holland plant, but quite distinct, for in that the inner 2 calyx lobes are twice the length of the outer three, leaflets "lanceolate," etc. *I. pentaphylla* has a lobed border, red and white flower, small rough exterior calyx lobes, etc.

Found by Prof. Geo. Davidson, U. S. Coast Survey, lat. 23° 03′, at San José del Cabo, Lower California, March, 1873.

Mr. Hastings read a paper on pavements, and gave descriptions of the pavements in use in ancient and modern times.

Dr. Stout exhibited specimens of the stone used in the construction of the U. S. Branch Mint in this city, and which was obtained at Vancouver Island; the iron contained in the stone becomes oxydized after a brief exposure to the weather, and changes from a bluish gray to a dingy yellow; the two pieces submitted for the inspection of the members were formerly in one piece, which was cut into two equal parts for the purposes of the experiment. Dr. Stout had experimented to see if the faulty color could be corrected, and the specimens before the Academy showed the result of his experiment. He had immersed the face of one of these pieces in sulphuric acid to a depth of an inch, and a comparison of the two pieces shows

that the process employed was successful; it would involve great expense to apply it to the Mint building, but could be used economically if applied to each separate dressed stone before being placed in the walls.

Dr. Stout suggested that a collection of samples of building stone should be made for the Academy's museum.

Mr. Stearns, on behalf of the special committee appointed at the last meeting, submitted the following:

Resolutions on the Death of Dr. John Torrey.

WHEREAS, the California Academy of Sciences has learned of the death of the eminent Doctor and Professor John Torrey, an honorary member and warm friend of this Academy, as well as personal friend of many of its members, and a distinguished scientist: it is

Resolved—That the California Academy of Sciences hereby express the profoundest regret at the death of its esteemed friend and late member, Prof. John Torrey, and lament his loss, not alone in its public aspect, from his high scientific attainments, but for the purity of his private character and the many estimable qualities which endeared him to his fellow-men.

Resolved—That the California Academy of Sciences extend to the family of their deceased friend the warmest regard and sincerest sympathy.

Resolved—That a copy of these resolutions be engrossed, and forwarded to the family of the deceased.

REGULAR MEETING, May 5, 1873.

President in the Chair.

A. P. Moore and Wm. W. Hollister were elected life members, and O. C. Pratt and Charles V. B. Keading were elected resident members.

Donations to the Museum: The first shad (*Alausa præstabilis*, De Kay) caught in the waters of California was presented by the Board of Fish Commissioners of California, through S. R. Throckmorton. Specimen of *Orchilla* from Magdalena Bay, presented by George Davidson. Specimens of Fishes, Crustaceans, Gorgonia, Sil-

ver ore, etc., from the late Lieut. Erasmus Dennison, through and in behalf of the messmates of the deceased, by Lieut. L. E. Chenery, U. S. N.

Donations to the Library: Washington Astronom. and Meteorol. Observations, 1870. Results of Washington Observations, 1853 to 1860. Memoir of the Founding and Progress of the U. S. Naval Observatory, by Prof. J. E. Nourse. Report on the Difference of Longitude between Washington and St. Louis, by Wm. Harkness; all of the above from the U. S. Naval Observatory, Washington, D. C. American Naturalist, Vol. VII, Parts 3–4. Am. Jour. Science and Arts, Vol. V, No. 28. Catalogue of Photographs from the Collections of the British Museum. A Contribution to the Icthyology of Alaska, by E. D. Cope, Pamph. 8vo. Const. and By-Laws of Acad. Nat. Sciences of Minnesota. Monatsbericht der Kögnig. Preuss. Akad. der Wissenschaften zu Berlin, Nov. and Dec. 1872. Proc. Royal Geog. Society, Vol. XVI, No. 5, and Vol. XVII, No. 1. Annalen der Physik und Chemie, 1873, Leipzig, Nos. 1 and 2. Canadian Naturalist, Vol. VII, No. 1. Cosmos di Guido Cora, Vol. I, Part 1, Turin, 1873. Cal. Horticulturist, April, 1873, from J. H. Carmany & Co. Proc. Acad. Nat. Sciences, Phila., Part 3, Oct., Nov. and Dec., 1872; also Part 4, pp. 57–200. Eng. and Mining Jour., Vol. XV, Nos. 10, 11, 12, 13 and 14.

Additions to Library by purchase: Popular Science Monthly, No. XII, No. XIII, 1873. Journal of Botany, London, Jan., Feb., March and April, 1873. Annals and Mag. of Nat. History, Jan., Feb., Mar. and April, 1873. Quarterly Jour. of the Geolog. Society, Vol. XXIX, Part 1, London, Feb., 1873. Quarterly Jour. of Micro. Science, London, Jan. and Apl., 1873. Bulletin of Essex Institute, Vol. IV, Nos. 9–10, 1872. Nature, Jan. 2 to April 3, 1873.

In connection with the specimen of Shad presented this evening, Mr. Throckmorton said that on the 27th of June, 1871, this shad was three-quarters of an inch in length, and was put into the Sacramento River at Tehama, after making a trip across the continent. One of the first efforts of the Commissioners was to get shad from the eastern coast, because it was emphatically a food fish; and the desire was to ascertain whether it could be propagated on this coast with success. The Commissioners opened correspondence with Mr. Seth Green on the subject of bringing over the ova of the fish. He discouraged the Commissioners at once, from the fact that the shad is hatched in from thirty-six to forty-five hours.

The Commission then tried to obtain a supply of water for transit of breeders, and the railroad companies were kind enough to give

them the use of a construction train for the purpose. Mr. Green said it was impossible to bring the adult fish across the continent, and it was useless to try. The Commissioners experimented on the last alternative. They sought from Mr. Green to ascertain whether it was possible for the young fish to live in fresh water instead of salt, long enough to cross the continent. They did not hear from Mr. Green for three months, and he stated that he had spent that time in experiments. He had hatched young fish, had kept them in glass jars, and had ascertained that life could be preserved for several weeks, and he could transport any number required.

He brought on to this coast 15,000. They were hatched in the Hudson on Saturday night, they arrived here on Tuesday week, and at nine o'clock that night they were placed in the Sacramento above Tehama. Mr. Green examined the water there and pronounced the conditions favorable. He afterwards examined the mouth of the harbor and found the feed good on the coast. No fish were lost on the way except those removed from the water for experiments. Above Tehama last year an Indian caught a little fish, and no one could tell what it was. Mr. Throckmorton had not seen it. The first which had been presented was caught recently in a trap below Vallejo. It was a male and was not full grown. The fish would be at maturity next year, and they might be expected in the harbor from the sea by the month of April. They would be full-sized breeding fish, and if a quarter of the 15,000 came back as breeding fish, they would be sufficient to stock our coast.

Last year the Commissioners had sent East for 50,000 fish, but the very hot weather which prevailed broke up the arrangement. This year the Commissioners have made ample arrangements for a supply of Eastern fish. They have now at Charlestown, New Hampshire, a full-sized car, which they have obtained from the Central Pacific Company. The car was being fitted up with all the appliances for the conveyance of a large consignment of fish; which will consist of black bass, white perch, yellow perch, and glass-eyed perch, eels, cat-fish and lobsters; and when it arrived at the Hudson River it would stop long enough to take in 100,000 shad. The car would arrive in California by the middle of June. From this consignment the Commissioners hoped to make a fair start in stock-

ing this coast with food fishes. They had taken no account of fancy fishes, but had endeavored to spend the moderate appropriation of the State for some permanently useful purpose. The reports as to other shad having been caught, the Commissioners have not been able to authenticate.

This season the Commissioners had brought across the continent a large number of white-fish eggs, and had succeeded in hatching about 25,000. They were now alive and well in Clear Lake, removed from all risk, having been placed there three weeks ago in a healthy condition. These fish had come from the northern lakes of New York.

Dr. Stout exhibited specimens of *Orchilla* and of a liquid dye from the same, which he had prepared by a peculiar process, and exhibited specimens of goods which had been dyed with this preparation.

Dr. Kellogg submitted specimens and descriptions of new plants, *Lilium Bloomerianum* var. *ocellatum* and *Aniseia azurea.*

Descriptions of New Plants from the West Coast of America.

BY A. KELLOGG, M. D.

Lilium Bloomerianum var. ocellatum, Kellogg.

Bulb purple, scales as in the original species, but the bulb often compound, 3 to 6 inches in diameter.

Stems 1 to 5 from a single or compound conglobate bulb; 5 to 7 or 8 feet high, sub-glabrous or slightly striguloid-scabrulose above, more or less purplish tinged; flowering at the summit only; 3 to 8 blossoms on somewhat erect-spreading peduncles, 3 to 6 inches in length, bent down and shortly curved at an abrupt angle beneath the flower, rarely bracted, except at the base.

Leaves in whirls of 5 to 10, sessile, lanceolate, 4 to 4½ inches long, ¾ to 1 inch in breadth, 5-nerved, glabrous above, lamina densely sub-discoid scabrulose beneath, and scabrous along the mid-rib below, margins waved scabrous, tips and upper margins usually purplish tinged. Flowers stiffly nodding. Campanulate, sepals many crested at the base chiefly on the inner series, 3 outer sepals plain above, at length more revolute than the inner series, claw 1-5th to 1-6th the blade; inner sepals somewhat broader, claws much shorter, 1-9th to 1-10th the blade, or longer than the mountain form, a double folded medium elevation marks the face, and a truncate slightly grooved ridge along the back the entire length; base reflexed, the upper 2-3ds gently recurved and aspiring aloft; all the sepals at the margins above and apiculate tips papillose. Color light orange ground, studded with ocellate blotches as if spattered with a dark purple pigment that had spread and tinged an areola around the spots, the

lower third or base being spotted with more numerous darker or nearly black and clean well-defined dots; stamens shorter than the style; the curved ascending style slightly streaked with broken purple lines, apex triangular-clavate, stigma undivided.

There are two varieties of *L. Bloomerianum* found growing together in the interior; one with bold, distinct and well-defined dark dots and spots, with longer sepals more attenuated above; the other with ocellate or nipple-like blotches, being broader and of more continuously oblong form. The same distinction into masculine and feminine forms is observed among these maritime lilies. The Island lily has slightly scabrulose stems, and more discoidly-scabrulose under surface to the leaves, and are always scabrous along the mid-rib beneath; whereas the Sierra Mountain lilies are mostly glabrous—sometimes pubescent on both mid-rib and nerves, but never scabrous; they also sport more leaves in the whorls, etc.; these also are broader, hence the greater number of nerves; the numerous flowers are usually (if not always) alternately distributed on longer and more divaricate peduncles. The slightly purplish scales of those of the mountains become very remarkably purple on the islands. The enormous gregarious bulb, with its numerous stems, is a peculiar feature not observed in the thousands of specimens hitherto examined.

Found by Mr. W. G. W. Harford, of U. S. Coast Survey, on Santa Rosa Island, growing on the west side of deep sheltered ravines, trending nearly north and south, hence, only where they get the *morning sun;* but are shaded from the ardent meridian, or post-meridian heat, which burns the leaves and kills them out on opposite exposures of the same locality. They are found growing in loose gravelly detritus of sweet, freshly made soils, on the high and dry well-drained or leaching benches, or steeper declivities, where thus sheltered they thrive the best, mid fogs and fierce cold winds.

We find no evidence of any proper description of this lily. The catalogue refers to scores of new lilies from this coast, among which is *L. Humboldtii.* It is proper to say, this has been kindly figured and sent to me by Max Lichten, of Baden; but that drawing is certainly our *L. pardalinum;* so far as our translation of the remarks of the author enables us to judge—together with the excellent painting — there can be no doubt as to the correctness of this conclusion.

Aniseia azurea, Kellogg.

Stem (perennial?) twining, terete, sub-striate, densely canescent-hirsute throughout. Leaves alternate, cordate, acute and acuminately mucronate, silvery alike above and below, petioles short, or about half an inch long, or half the length and breadth of the blade (in full grown leaves), slightly decurrent, base 5-nerved, alternate veined above, margins sometimes slightly repand, and somewhat oblique. Long axillary peduncles spreading at a right or depending obtuse angle, rarely deflexed with a somewhat ascending sweep, 2 to 2½ inches in length, terminated by a short cymule or condensed raceme. Calyx of 5 unequal sepals, persistent, enveloping the capsule, 2 or 3 outer sepals much larger, ovate acuminate filiform-attenuate, 2 inner smaller, ovate-lanceolate filiform sub-

ulate, sub-scarious below, chiefly the 3 outer with a rigid chartaceous concave glabrous central pitted portion, the flaccid herbaceous surrounding parts partially hirsute on the face, and altogether so on the back.

Bracts, and intermixed bracteoles, similar, or subulate-filiform, 1 or 2 at the base of each articulated pedicel, very hirsute, ¼ to ½ an inch in length, or longer than the pedicels. Flowers small, tube very short, funnel-form border nearly entire, or emarginated, glabrous, (æstivation plicate) ¾ to 1 inch expansion, bright blue, star bands whitish taper-pointed, genitals exsert. Stamens short, flattened filaments attenuated upwards, ciliate below, inserted into the base of the tube. Style 1, somewhat longer than the stamens, stigma 2-lobed, lobes ovate, flattened, spread at a right angle. Capsule conoidal sub-prismatic, 2-celled (perhaps at length becoming 1-celled?) 2 seeds in each cell, or 4-seeded, 2 to 4-valved, splitting also at the nerves as well as opening at the angles; seeds roundish on the back and sub-plane on the face, smooth (?) [It is difficult to make out the character of the capsule to entire satisfaction, for want of the mature fruit.]

As D. C. gives the complanate stigma place in his description of *Aniseia*, we place our plant here provisionally.

Found by Prof. Geo. Davidson of U. S. Coast Survey, on his recent (March, 1873) visit to San José del Cabo, near Cape St. Lucas, Lower California, in lat. 23° 03′.

The Abrasions of the Continental Shores of N.W. America, and the supposed Ancient Sea Levels.

BY GEORGE DAVIDSON.

In continuing my examinations of the well marked benches or plateaus bordering the Pacific Coast northward of Cape San Lucas, I have been constrained to doubt their marking the ancient sea levels arising from an elevation of the coast line, or that they were the work of water alone.

That some few of the smaller ones, which are composed of gravel, etc., were made by the action of water, and may mark ancient sea levels, I think may be admitted; but those that exhibit, on an extended scale, level plateaus of rock, which has every degree of inclination or contortion of stratification, and an infinite variety of texture, cannot have been so wrought.

Other forces more powerful and more uniform and constant in action than water, shaped these flat-topped rocky benches or plateaus; and those forces, if more than one, abraded the present continental line of our coast and the larger islands of the Santa Barbara Channel.

The terraces may have been formed at the surface of the sea, or above it, but more likely beneath it, and subsequent elevation of the land brought them to their present positions.

Much of the sharp outlines of this abrasion and terrace-forming has been obliterated by subsequent causes; principally by water from precipitation, alternations of heat and cold, and the action of waves.

I will enumerate the principal examples which I gathered on my recent trip to Mexico, together with those which I have examined in past years, to the northward and southward of San Francisco, and offer some examples from my sketches and from photographs.

Commencing at the southward I could, in my trip of last March, detect no lines of terraces or plateaus whatever at the extremity of the Peninsula of Lower California, if we except the peculiar form of the summits of two or three mountains to the eastward of San José del Cabo. Thence towards Magdalena Bay I had no view of the coast; but on the island of San Margarita, and the great headland of Cape Lazaro, forming the ocean bulwark to Magdalena Bay, and reaching 2,500 feet elevation, I discovered no signs of terraces on the ocean or bay sides.

Of the coast from Cape Lazaro to Cape Colnett, in latitude 31° north, I cannot speak, except of a long table ridge lying inland from Point Abreojos, in about latitude 27°. It had the same peculiar features as the mountains referred to near San José del Cabo.

Northward of Cape Colnett I had very favorable opportunities to study the coast line, and made many views to illustrate the numerous and very marked examples of terraces that are cut and planed in the flank of the high rocky coast barrier. Vancouver has a view of the mesa or table forming Cape Colnett, with the strata inclined at a large angle and the surface cut off quite level.

The Point near Solitarios Rocks, in about lat. 31° 32′ is a well marked table of about 150 feet elevation, with a lower table towards the extremity of the point, visible when it bears E. S. E.

Five miles southward of Point Grajero, about latitute 31° 35′, a deep, cañon-like valley opens upon the ocean, and exhibits numerous and very sharply marked rock terraces on both sides and at all elevations, reaching nearly a thousand feet. The cañon stretches well back into the mountains.

The northernmost of the Todos Santos Islands, about latitude 31° 40′, and not laid down on recent charts, is itself a well marked, rocky, horizontal plateau, thinly covered with soil; whilst the southern island has two terrace marks, the lower corresponding to the level of the top of the northern islet, another higher one, near the summit of the islet, about twice the height from the sea. Even a lower terrace line may be traced about 15 feet above the present sea level.

When passing abreast the northern point of Todos Santos Bay, no less than four well marked terrace rocky points, projecting into the ocean, were sketched in the same view. Each point had other terraces of greater elevations rising inland; whilst to the northward stood out the well known Table Mountain with its remarkable flat top, 2,244 feet above the sea, and having a breadth of 4,800 feet. On this single view no less than fourteen terrace markings are exhibited, including Table Mountain. The vicinity is the best marked terrace formation that I know of on the coast. They are not made in soft soil, but appear as if a planing machine had cut them out of the solid rocks.

The coast line just south of the boundary of California and Lower California exhibits a single terrace stretching some distance southward.

Northward, between Point Loma and San Juan Capistrano, a broad table land of 100 to 300 feet elevation and many miles long, is familiar to all who have traversed that country by stage; at certain points there are, over the plateau, gravel deposits of peculiar shape, for which I have in vain endeavored to find a cause in the movement of water. Their low rounding summits are about two feet above the general level, from twelve to twenty feet in extent, and lie contiguous to each other over occasional large areas, ceasing suddenly and giving place to the very flat table. The fullest effect of their shape is seen at sunrise, with the long shadows filling the intervening depressions.

On passing San Pedro hill the lines of the terraces were peculiarly well marked by the brighter lines of gay flowers seen from seaward on their comparatively level surfaces. The traces of these terraces are cut in rock, and are readily traced in the detailed topographical map by the Coast Survey. The view made by me shows five principal terraces which the contour sheet of topography indicates.

The lowest terrace is about 65 feet above the sea; 2d, 140; 3d, 260; 4th, 360; 5th, 580; several smaller ones about 700 and 800, and other especially marked ones at 900, 1,000 and 1,200 feet. The hill itself is rounded, and at its highest point is 1,478 feet above the sea. The five principal terraces are on the southwest face, but the greater number on the northwest end of the hill.

The "mesa" lying fifteen miles to the northwest of Point Vincente, is a capital example of the flat terrace, and is reproduced on the coast line under the southern flank of the Santa Monica range, at a point about twenty miles westward of Los Angeles. At the mouth of the Arroyo Santa Monica, the table, several miles in extent, has an elevation of about 90 feet, and terminates as a bold rocky bluff on the sea. Within this arroyo are several smaller terraces which may have been formed by water.

Point Dume, lying about 25 miles W. N.W. from Point Vincente, is another well defined table, where a projecting spur from the mountains has been planed off for two or three miles, whilst towards the extremity a deeper grooving has been ploughed out and left the head as a dome-shaped point.

At San Buenaventura, and hence toward Point Concepcion, we find numerous narrow rocky plateaus, but most markedly exhibited in the vicinity of Point Concepcion, where the bluff exhibits every inclination of stratification, but the top is flat and comparatively smooth. It is a counterpart of Point Dume, but more extended.

Among the islands of the Santa Barbara Channel, San Clemente and San Nicolas are both long, comparatively flat topped mountains; but the principal feature of the southern group is the remarkable parallelism of their longer axes, and also of the channels which have been cut through the group lying off the Santa Barbara shores; and this parallelism is continued in the coast line of the Santa Lucia mountains, Mount Buchon, Point Arguello to Concepcion and San Pedro hills.

Anacapa Island, lying in the throat of the Santa Barbara channel, and directly abreast the opening of the extensive valley of Santa Clara, consists of a very narrow five mile ridge of coarse dark gray sandstone; two-thirds of the length, reckoned from the eastern extremity, has been planed off. The sides are perpendicular, and the summit of the eastern part about 300 feet above the sea, whilst the western part rises to 930 feet in height, but the line of the level of the summit of the eastern parts is marked around the flanks of the western, notwithstanding the deep gulches, with almost vertical sides, which cut from the summit to the top of the bluff.

On the northwestern flank of the Monte del Buchon, lying between San Luis Obispo Bay and Los Esteros, although cut by deep gulches, there are three very plainly marked terraces, each of several hundred feet in height; no other point is more plainly marked.

The seaward flanks of the Santa Lucia range, between San Simeon Bay and Monterey Bay have occasional terrace markings, but the precipitous and high face of the mountains has apparently permitted less marked abrasions than at other points, or subsequent causes have obliterated them. This range contains the highest peaks along the immediate coast of California or Oregon, some of them reaching 5,700 feet elevation.

At Santa Cruz Point, and hence to the northwestward, a pretty table bluff exists. Thence to San Francisco we have several examples of the flat-topped rocky terrace. Before reaching the Pescadero "the general formation of the immediate seaboard for twelve miles is that of a table land of three terraces, the lowest gradually sloping from the base of the second to the coast, which is exceedingly rocky and forbidding."

But it is not necessary to multiply instances. Passing rapidly to the northward as far as Point Arena, in latitude 39°, I have examined the plateau at the lighthouse point, as well as the others towards Arena Cove, but I bring the former to your notice, because a photograph of the point exhibits the stratification as almost perpendicular, and shows the present broken condition of the bluff and low water level, arising from the action of water and weather. The terrace at the Point is about 40 feet above the sea, covered with a very thin stratum of soil, and for a distance of half a mile a base line was measured by the Coast Survey with a difference of level on the plateau of about two feet; the same level is maintained among the timber.

In this, as in most of the other cases I have mentioned, the rock appears to have been absolutely planed off, and that the different degrees of hardness of the stratification had no apparent influence upon the mechanical causes at work. Other terraces near the cove reach over 200 feet elevation, and whilst the bluffs for miles exhibit every contortion of stratification and every degree of hardness, the surfaces of the terraces are planed off.

The shores of Mendocino Bay, Points Cabrillo, Delgado, Table Bluff, and Cape Orford tell the same story. The latter bears a marked resemblance to Points Concepcion and Dume. Three miles south of the Cape the terrace is a fine blue sandstone, full of fossil shells. Thence northward the signs are few.

About Capes Mendocino and Fortunas are one or two slight indications of terraces as viewed from seaward, but northward of these Capes the climatic conditions of the seaboard change, and they appear to have acted more energetically than to the southward. Nevertheless,as we approach the Strait of Fuca we have evidences of a single line of flat topped rocky terrace, from Point Grenville to Tatoosh Island.

Destruction Island, in latitude 47° 41′, is one or two miles in extent, rocky, bold and flat-topped, about 75 feet above the sea. The bluff of the adjacent main shore possesses the same characteristics, as shown by the view on the Coast Survey chart.

Off Cape Flattery, in latitude 48° 24′, lies Tatoosh Island, 108 feet high, bold, rocky, and flat-topped. Fuca's Pillar and other rocks off the Cape have the same elevation.

With the outer shores of Vancouver and Queen Charlotte's Islands I am not familiar, but I have failed to find, among the views and descriptions of the old or recent navigators, any indications of terrace formation. Nor have I found them for certainty among the inner passages of the great archipelago extending from Olympia, in 47°, to the mouth of the Chilkaht in 59°, although I have discovered and measured the direction and depth of the markings of ice action among the islands of Washington Sound and the adjacent parts of Vancouver Island, both in the clean cut and very deep groovings, and in the presence of large numbers of huge erratic boulders.

Of the topographical or geographical details of the shores of the Gulf of Alaska, we know very little. La Perouse, in approaching the coast under Mt. St. Elias, thus describes it: at the same time I must confess to receiving all his descriptions with a certain amount of reservation : "The mountains appeared to be at a little distance from the sea, which broke against the cliffs of a table land 300 or 400 yards high. This plain, black as if burned by fire, was totally destitute of verdure. * * * As we advanced we perceived between us and the elevated plateau, low lands covered with trees which we took for islands. The table land serves as a base to vast mountains a few leagues within. Approaching the coast we saw to the eastward a low point covered with trees, which appeared to join the table land, and terminate at a short distance from a second chain of mountains."

Middleton Island, in the Gulf of Alaska, in latitude 59° 30′, is the only flat-topped rocky island mentioned or depicted by any of the navigators. It is about seven miles long, north and south, with a breadth of three miles. The surface of the island is comparatively low, quite level, and destitute of trees; the shores are craggy. Belcher says it does not exceed thirty feet in height, and has a very soft spongy soil over micaceous shale, interspersed with quartz dykes.

The southern point of Kayak Island, in 59° 49′, is a high table rock, as described by Belcher.

Long Island, off the harbor of St. Paul's, Kadiak, and Chiniak Point are flat-topped and rocky, but not well marked.

Among the Aleutian Islands or along the Peninsula of Alaska, I saw no terrace formations such as I have before described, and I fail to find amongst the navigators, up to 1855, views that indicate such features. To the far north, in the Behring Strait, the English views represent the rocky Diomede Islands as bold, high and flat-topped, as well as the east cape of Asia.

In all these instances, and in others not enumerated, we find a prevailing feature, regardless of the dip or direction of the stratification of the rocks. A nearly level surface of rock with a comparatively thin layer of soil thereon; the plateaus sometimes miles in extent, bordering the coast line with jagged cliffs, which illustrate the action of water and weather. Above these plateaus are frequently others stretching inshore, and reaching elevations of certainly 1,200 feet, and probably more.

Whilst the general plateau is level, or nearly so, there are numerous indications that broad groovings have been made across them, as exhibited in the views of Points Dume, Concepcion and Orford, and across the ridge of Anacapa Island. And it is noticeable that these ploughings or groovings are across the points and across the islands, and run with the general trend of the Coast line.

These prominent features are sufficient to satisfy us that more effective and more regular agencies were at work to form them than are at work on such a vast scale to-day.

The upheaval of the continental shores by subterranean action can not produce such terraces and plateaus; if the shores of the Pacific were to-day to be raised, say 200 feet, we know from the depths bordering it, that such results would not be one of the consequences. The action of water will not account for them. Whether by "continual dropping" or by storms, it first wears away the soft and more friable parts, leaving the harder; it destroys shores by undermining, and then grinding it leaves irregular jagged surfaces. These irregular surfaces, if upheaved above the level of the sea, would not wear away regularly by the weather; the inequalities would in time be filled by disintegrated material, but the surface of the rock would not bear the impress of a planing machine. We must be guided in great measure by experience, and judging by our knowledge of present local glacier action, I think we can appeal to the action of ice, moving slowly but surely, as a great planing or moulding machine; its lines of movement perhaps controlled by masses and elevations of land not now existing as such, and by forces no longer acting on such a scale. We may suppose a great ice belt to have existed contiguous to the continent and moving parallel with it; and existing at the same period with the ice sheet that covered the continent or the lower parts thereof. Some of the mechanical effects of this belt may be those we see exhibited upon the islands and the general coast line; the effects of the latter in the gorges opening upon the shores in the interior valleys, and on the mountain flanks when at right angles to the coast line.

All the groovings on Vancouver Island and the islands of Washington Sound, at the southern extremity of the Gulf of Georgia, point to the agency which causes them as moving southward, and if we accept an ice sheet over the con-

tinent, or a part thereof, and an ice belt contiguous to the continental shores, we can readily understand from the manner of the formation of glaciers that it moved as a great stream, or, more likely, in currents, from the north; probably with extreme slowness, but with certainty.

Moreover, a body of ice contiguous to the shores of the continent will do its work more or less effectually and at greater or less depths, in proportion to its rate of progress and its thickness; so that we can understand how terraces of different elevations may have been formed during that period, without any relative change of the level of the sea and bordering land, although the same general effects would have been produced if the land had been rising or subsiding.

Moreover, the mass of ice resting on the land may have done similar work above the level of the sea, to what may have been beneath it.

Thus these terraces may not indicate the different steps of the elevation of the continental shore; and instead of resorting to the theory of great and violent upheaval, *per saltum*, we see how the elevation may have been gradual, and even after the terraces have been formed. This gradual movement of elevation is indicated by the present level character of the plateaus, or when very broad, by their slight inclination.

I do not propose to offer any explanation as to how the ice belt was formed, or how it acted; whether as a great body, disconnected from the continental ice sheet, it moved slowly down the coast line by the combined forces of ocean currents and the pressure of the greater masses from the northward; or whether it moved as a part of the great ice sheet from the northward.

The evidences of these terraces seem to be found in greater proportion between latitudes 30 and 42 than further to the north, and this may, in a measure, be thus accounted for.

Since the period of upheaval succeeding the terrace formation, general and local climatic changes have doubtless taken place, tending to the destruction of the terraces, and as they were formed in sedimentary rocks, most of their finer markings have been obliterated. Throughout the coast line, below latitude 40°, we find that after the terraces have been elevated, the disintegration of higher lands took place with greater activity than at present, and yet the material was carried downward without great violence, and formed long, gently inclined slopes from the base of the mountains towards the shores or into the valleys. One of the finest examples of this is in the Valley of the Santa Clara, east of San Buenaventura; another is the Valley of San José, Lower California, whilst innumerable examples abound on a smaller scale along the flanks of our mountains. Such results may have taken place under a climate of great heat and excessive moisture, with unceasing precipitation, but without violent rains to create torrents, and assisted by the colder weather of winter. Subsequently these gently sloping deposits were cut through by torrential forces, which are yet at work, but on a decreased scale.

On the coast line many cases can be seen where these long sloping deposits of disintegrated material have been cut through by subsequent torrents, and are now being undermined and washed away, so as to expose the flanks of the moun-

tains behind them. A notable example is that just north of Judas Head, on the Island of Margarita.

To the northward it is reasonable to suppose that the ice belt lingered longer than at the south, and that when it was dissipated, the destructive agencies of great climatic changes and excessive rainfall were much more active and wearing. Above latitude 40° we do not find the long, gently sloping surfaces of disintegrated material; as we advance, even the steep sloping hill sides give way to the fiord-like coasts of Vancouver, and the Archipelago Alexander. There violent storms, excessive moisture and precipitation, and great thermal changes, are producing a hundred-fold greater effect than to the southward, and obliterating whatever evidences existed of the terrace formation. The terraces may have been but partially developed on account of the direction of the movement of the ice-belt not following the trend of the coast line from the westward; or there may have followed a subsidence instead of an elevation of the continental shores of Alaska, as I have elsewhere indicated.

For illustrations to this article, see Plate V.

Regular Meeting, Monday, May 19th, 1873.

President in the Chair.

Twenty-three members present.

Major-General J. M. Schofield, Eusebio Molera, and Prof. D. McClure, of Oakland, were elected resident members; and Dr. Franz Steindachner, of Vienna, Austria, a corresponding member.

Donations to the Museum: Specimen of a Hawk; also specimens of a species of Fox (*Vulpes littoralis*, Baird), the latter from Santa Rosa Island, by W. G. W. Harford. Specimen of Trunk-fish (*Ostracion*), from Enderbury's Island, Lat. 3° S., Long. 176° W., found under the edges of coral reefs; presented by C. A. Williams, of Honolulu. Specimens of *Velella*; also fishes, from off Cape St. Lucas, Lower Cal., by Dr. Schlatter, of the P. M. S. S. Co. Infusorial Earth from Catalina Cove, Santa Barbara channel; also specimens of Gypsum, from Santiago Cañon, Los Angeles County, presented by A. W. Chase, U. S. Coast Survey.

Dr. James Blake read the following:

On the structure of the Honey-bag in the Honey-making Ant *Myrmecocystus Mexicanus*.

BY JAMES BLAKE, M.D.

Having prepared the two specimens of the honey-making ant that were exhibited in connection with Mr. Edwards' paper at a previous meeting of the Academy, I have been enabled, by preserving them in a solution that renders the sack containing the honey perfectly transparent, to ascertain the curious fact that the intestine of the insect is not continued beyond the thorax, so that there is no way in which the remains of the food can be expelled from the body, except by the mouth. The honey-bag is evidently formed by the expansion of the abdominal segments, as the remains of the four chitinous rings in which it was originally enclosed are still visible. The first ring anteriorly retains its connection with the thorax, the posterior part being split so as to expand. The remains of the other rings are seen as small scales on the dorsal and ventral surfaces of the honey-bag. The éxpansion of the abdominal cavity has not taken place evenly, as the orifice of the *cloaca* with the *ovipositor*, which in the ant is situated at the end of the abdomen, is now found at some distance from the end on the ventral surface, so that the expansion of the abdomen has evidently been greater on the dorsal than on the ventral surface. One curious fact resulting from the want of connection between the intestine and the cloaca is, that all the food the animal takes must go to form the honey, with the exception of the small quantity consumed in keeping up the functions of the body. This is the more singular, when we consider the habits of the insect as described by Mr. Edwards, as these would apparently render it almost impossible that they should be supplied exclusively with nectar from the flowers.

New Problems in Mensuration.*

BY GEORGE DAVIDSON.

XIII. Having given the sides of a rectangle, determine, in terms of those sides, the sides of a required consecutive series of interior hollow rectangles and central rectangle, into which it may be divided, having equal areas with each other.

To divide it into n hollow rectangles, and the central rectangle; call l the length and b the breadth of the given rectangle; x, y, etc., the required lengths next interior; x', y', etc., the corresponding breadths; $(w-1)$ and w the last two lengths, and $(w'-1)$ and w' the last two breadths; then

$$x^2 = \frac{(n-1)\,l^2}{n},\ x'^2 = \frac{(n-1)\,b^2}{n}:\ y^2 = \frac{(n-2)\,l^2}{n},\ y'^2 = \frac{(n-2)\,b^2}{n}:\ \text{etc.}$$

*In continuation of former problems in this and in Vol. IV.

$$(w-1)^2 = \frac{2\,l^2}{n},\ (w'-1)^2 = \frac{2\,b^2}{n}\ :\ w^2 = \frac{l^2}{n},\ w'^2 = \frac{b^2}{n}$$

XIV. Having given the sides of a hollow rectangle, determine, in terms of those sides, the sides of a consecutive series of similar hollow rectangles, of equal areas with each other, into which it is required to divide the given hollow rectangle.

To divide it into n hollow rectangles, let l' represent the outer and l the inner lengths of the given hollow rectangle; b' the outer, and b the inner breadths; x, y, z, etc., the consecutive lengths, reckoning from l' to l; $x'\ y', z'$, etc., the corresponding consecutive breadths; $(w-1)$ and w the last two lengths, and $(w'-1)$ and w' the last two breadths; then

$$x^2 = \frac{l'}{b'}\left\{\frac{b\,l + (n-1)\,b'\,l'}{n}\right\},\quad x'^2 = \frac{b'}{l'}\left\{\frac{b\,l' + (n-1)\,b'\,l'}{n}\right\}$$

$$y^2 = \frac{l'}{b'}\left\{\frac{2\,b\,l + (n-2)\,b'\,l'}{n}\right\},\quad y'^2 = \frac{b'}{l'}\left\{\frac{2\,b\,l + (n-2)\,b'\,l'}{n}\right\}\ :\ \text{etc.}$$

$$(w-1)^2 = \frac{l'}{b'}\left\{\frac{(n-2)\,b\,l + 2\,b'\,l'}{n}\right\},\quad (w'-1)^2 = \frac{b'}{l'}\left\{\frac{(n-2)\,b\,l + 2\,b'\,l'}{n}\right\}$$

$$w^2 = \frac{l'}{b'}\left\{\frac{(n-1)\,b\,l + b'\,l'}{n}\right\},\quad w'^2 = \frac{b'}{l'}\left\{\frac{(n-1)\,b\,l + b'\,l'}{n}\right\}$$

XV. Having subdivided the hollow rectangle, as in problem XIV., determine, in terms of the given sides thereof, the sides of a consecutive series of similar hollow rectangles inside the given rectangle, and having areas equal with those of the prescribed subdivisions.

Suppose the given hollow rectangle is subdivided into p hollow rectangles, and there are required n inner hollow rectangles of equal areas; let l', l, b', b, x, y, z, etc., x', y', z', etc., represent quantities as before; and i', i'', i''', etc., the consecutive lengths, reckoning from l toward the center; $\mathbf{i}', \mathbf{i}'', \mathbf{i}'''$, etc., the corresponding consecutive breadths; then

$$i_n^2 = \frac{l}{b}\left\{\frac{(n+p)\,b\,l - n\,b'\,l'}{p}\right\}$$

$$\mathbf{i}^2_n = \frac{b}{l} \frac{(n+p)\, b\, l - n\, b'\, l'}{p}$$

XVI. Having subdivided the hollow rectangle, as in problem XIV., determine, in terms of the given sides thereof, the sides of a consecutive series of similar hollow rectangles, outside the given rectangle, and having areas equal with those of the prescribed subdivisions.

Suppose the given hollow rectangle is subdivided into p hollow rectangles, and there are required n outer hollow rectangles of equal areas; let l', l, b', b, x, y, z, etc., x', y', z', etc., represent quantities as before; and o', o'', o''', etc., the consecutive lengths, reckoning from l outward; $\mathbf{o}'$, $\mathbf{o}''$, $\mathbf{o}'''$, etc., the corresponding consecutive breadths; then

$$o^2_n = \frac{l'}{b'} \left\{ \frac{(n+p)\, b'\, l' - n\, b\, l}{p} \right\}$$

$$\mathbf{o}^2_{\overline{n}} = \left\{ \frac{(n+p)\, b'\, l' - n\, b\, l}{n} \right\}$$

Descriptions of a New Genus, and two new species of Plants from the Pacific Coast of America.

BY A. KELLOGG, M. D.

The following plant has somewhat the appearance of a very branching specimen of *Helianthus giganteus*, and is closely allied to *Parthenice* of Gray.

Generic Description.

Parthenopsis, Kellogg.

Heads broadly campanulate, with loosely sub-imbricated foliaceous and membranaceous involucral scales, many-flowered, elongated pistillate ray flowers, about 11 or 12 from the axils of each of the inner hyaline involucral scales, but entirely free; those of the disk tubular and perfect, about 60. Involucre in somewhat several merging series, outer more loosely spreading; the two outer sub-series leafy; and about 2 to 3 inner membranaceous series slightly colored (greenish yellow), the two outmost marrow scales short, distinct, lanceolate acute (3-nerved), the other 3 or 4 of this foliaceous series larger, very broadly ovate sub-imbricated and coherent into the broad united or entire base of the common involucre (5 to 7-nerved). The more or less membranous colored (greenish yellow) series consists of about 5 very broadly ovate obtuse membrano-coriaceous serrate scales narrowing into about 5 or 6 oval-oblong subobtuse serrate and more scarious scales; and successively into final hyaline acut-

ish serrate series of about 10 or 12 flat and perfectly free persistent scales. Receptacle broad (about ½ an inch or so) flat, naked, or only subpubescent, areolate. Rays about 11, oblong-lanceolate about 3-toothed (3–5 ?—middle tooth longest) tube very short hirsute with white jointed hairs, pistils much exserted, lobes recurved, tipped with a short cone; disk florets 50 to 60, tubular slightly dilated below, abruptly narrowed into a very short tube also hirsute with white jointed hairs and stipitate glands 5-toothed recurve spreading border, and glabrous teeth; filament stipitate-glandular; style bulbous at the base, deeply divided above, recurved and with the yellow staminal tube exsert, lobes tipped with a very short sub-obtuse cone, hispid on the back. Achenia of disk and ray similar, free, oblong, obcompressed narrowing towards the base, sub-3-sided, glabrous or a few scattered striguloid-tubercles and broken crenulated lateral margins, slightly incurved, a little convex, carinated and 3-nerved on the back; face 1-ridged and 5-nerved, apiculate, all naked, being neither toothed nor notched (not a vestige of rudiments seen).

A perennial branching maritime shrub 6 to 8 feet high, with bright yellow helianthoid flowers, about 2 inches in diameter; on terminal naked peduncles, usually, if not always, in pairs opposite the final mature leaf—strong Artemesia odor.

Parthenopsis maritimus, Kellogg.

A woody perennial; broadly branching alternately above, erect, (bark of body pearly grey—twigs dark madder-purple), puberulent in the young state, 6 to 8 feet high, ½ to 1 inch in diameter. Leaves deciduous, cordate-deltoid and deltoid acute, ovate, and ovate-oblong acute or acuminate, base rarely subcuneate or oblique serrate, dentate or repand-dentate 3–5-nerved or triplinerved close above the (sometimes obscurely) 3-nerved base, margins slightly scabrous; lamina thin, green above and pea-green beneath; sparsely pubescent on both sides, petioles slender, ¼ to ½ or so the length of the blade, sub scabrous, alternate, rarely the upper pairs opposite, 2–6 inches or more in length, 1 to 4 inches in breadth; peduncles in pairs, or di-ortrichotomous, opposite the extreme developed leaves, naked, as long, and one usually longer, than the petiole (or 1½ to 2 inches in length). Involucre in 2-many series; outer leafy, several from the first broadest colored series, successively diminishing to hyaline marginal discoid (?) scales. Rays an inch or more in length (or about twice or thrice the disk) oblong-lanceolate 3 or more toothed, middle tooth longest, etc. Flowers yellow, 2½ to 3 inches in diameter; disk florets with a cylindrical prolonged throat, slightly swelled pubescent and stipitate-glandular below, 5-toothed glabrous border, teeth short, triangular-acute recurve-spreading, abruptly narrowed into a short tube, hirsute with unequal massed white frosty jointed hairs, and stipitate glands intermixed; style exsert (purplish lobes) revolute, cone tipped, pappillose and hispid on the back, base bulbous and glabrous; (florets and anthers yellow), lance-pointed united, filaments stipitate-glandular, (rarely a little hirsute also); achenia of disk and ray similar, all naked and free, the firtile very dark purple, and less striate but more tuberculate throughout. Receptacle not at all chaffy, scarcely puberulent, flat, areolate.

Found by Mr. W. G. W. Harford, on Santa Rosa Island, off the coast of Santa Barbara, 1872–3. A very showy plant but having a rather too strong *Artemesia* odor to be agreeable. Similar to *Euphrosyne*.

Closely allied to *Parthenice*, Gray, Pl. Hort., p. 85, but that has a hemispherical head—oval and orbicular obovate convex receptacle, doubly dentate leaves; founded on a plant with heads 2 to 3 *lines* in diameter.

Dendromecon Harfordii, Kellogg.

Stem shrubby, branches glabrous, whitish or creamy bark obtusely angled by the decurrent mid-ribs, (axillary buds conspicuous).

Leaves variable, from roundish to sub-cordate-ovate, ovate, or ovate-oblong-obtuse, mucronate with sub-cuneate base; or elliptic, short or abruptly cuspidate-acuminate, 3 to 5-nerved or more (7), and triplinerved above (mid-rib often colored orange) margins entire, denticulate or serrate, petioles very short, decurrent-winged; foliage large (1–3 inches long, ½ to 1½ inches wide) densely crowded or imbricated, thick, coriaceous, rigid and tough, strongly reticulated light greenish yellow, peduncles very short with many leafy bracts, mostly in pairs or solitary; style one, stigma 2-lobed, lobes sub-sessile or on short limbs (about ½ a line long) each irregularly 4-lobed (purple); pods 10-ribbed; seeds fig-shaped ribbed longitudinally, a placentiferous like pseudo-arillus on the funiculus between the seed and point of attachment (often bright orange colored).

Found by Mr. W. G. W. Harford on the Island of Santa Rosa, off the coast of Santa Barbara, April, 1872.

Dr. Kellogg presented specimens, accompanied by a painting, of *Antigonum Leptopus* var. *splendens*, Kellogg, collected by Prof. Geo. Davidson, of U. S. Coast Survey, at San Jose del Cabo, near Cape St. Lucas, Lower California, at. 34° 03′, in March, 1873.

This specimen combines the characters of several species, besides we have the seeds not before sufficiently noted. The flexuous branches are pentagonally striate ridged, and the whole plant remarkable for its densely villous, or short ferrugio-canescent-hirsute character throughout, with no appreciable approach to smoothness; the leaves are not "entire" but emarginate, acute, mucronate, not "acuminate," nor decurrent; but like *A. Guatamalense* the racemes are axillary, not "opposite the leaves," and the tendrils both lateral and terminal; pedicels sessile or sub-sessile on short stipes and in fasicles of 1 to 4 (not 1 to 3) articulated below the middle; bracts minute, pseudo-bracteoles (several from abortion of pedicels) rather more ovate-acuminate; filaments stipitate-glandular, sometimes extending to the base of the investing stamenal cup, with numerous sessile glands, a few of which are scattered over the inner face of the (quincuncially imbricated) sepals; stigmas depressed-capitate both reniform and bilobed; stamens longer than the styles, these, like the sepals, enlarge after infloresence, becoming very dark purple almost black; styles 3 (rarely confluent into one, at the base); the margins of the obtuse (or subacute) sepals minutely ciliate (the 2

lesser inner only on one edge) mucronate. Capsule (not "achenium?") three-seeded; seeds not "pyramidal," but sub-triangular, *i. e.*, with two plane faces, and the back convex.

All climbers have peculiar claims to a beauty of their own, but this, with its large terminal clusters of brilliant carmine flowers, is the most striking of them all.

Regular Meeting, June 2d, 1873.

Vice-President in the Chair.

Thirty members present.

W. W. Montague and A. W. Chase were elected resident members.

Donations and Additions to Library: Smithsonian Reports (3 vols.), for 1863, 1866, 1867. Lists of Elevations in that portion of the U. S. west of the Mississippi river, by Henry Gannett, for Department of the Interior. Nature, Nos. 181–3. California Horticulturist, May, 1873. Engineer and Mining Journal, Vol. XV., Nos. 16–19. Astronomical Register, for May, 1873. Bulletin of the Essex Institute, Vol. IV., Nos. 11 and 12; and Vol. V., Nos. 1, 2. Bulletin of the Buffalo Society of Natural Sciences, Vol. 1, No. 1. Catalogue of the Pyralidæ of California, etc., by A. S. Packard, Jr., from the Author. Proceedings Academy Natural Sciences of Philadelphia, pp. 201–332. Views of Nature, etc., by Ezra C. Seaman, from the Author. American Journal of Science and Arts, Vol. V., No. 29. Annals and Magazine of Natural History, Vol. II, No. 65, May, 1873. De la Composition des Eaux Minerales de Spa, by Messieurs Chandelon, Donny, Kupfferschlager, and Swarts. Dijon, 1872, from the Authors. Catalogue of the Echinodermata of New Zealand, with Diagnoses of the Species, by F. W. Hutton, F. G. S., from the Author. Sixth and Seventh Annual Reports on the Colonial Museum, etc., of New Zealand; also, Reports of Geological Explorations of New Zealand during 1871–2, from the Director, James Hector, M.D., F.R.S. On a Method of Detecting the Phases of Vibration in the Air, surrounding a Sounding Body, etc. On a Method of Measuring the Wave-lengths and Velocities of Sounds in Gases, etc. On the Experimental Determination of the Relative Intensities of Sound, etc. On a New Form of Lantern Galvanometer. On a Method of Tracing the Progress and of Determining the Boundary of a Wave of Conducted Heat; 5 pamphlets, 8vo., by Alfred M. Mayer, Ph. D., from the Author. American Chemist, Vol. III, No. 2, May, 1873. Ornithology of Samoa, etc., by Dr. O. Finsch. Temperature Chart of the United States, from Smithsonian Institution.

Donations to Museum: Shells from near Anaheim, from A. W. Chase, U. S. Coast Survey. Reptiles, several species, from Inyo county, by H. G. Hanks; Borate of Lime, from the Lone Ranch Borate Mining Company.

Mrs. E. S. Carr, in behalf of Mr. John Muir, read a paper on "Explorations in the Great Tuolumne Cañon." [This paper was not submitted for publication, but was subsequently published in the *Overland Monthly*.]

Regular Meeting, June 16th, 1873.

Mr. Stearns in the Chair.

Twenty-one members present.

George W. Lewis, Cutler McAllister, John R. Jarboe and Agapius Honcharenko were elected resident members, and W. C. Ralston life member.

Donations to the Museum: Specimens of *Gorgonia* from Cerros Island, and skull of a fish, presented by Capt. J. A. Wilson, of San Pedro. Skull of mountain sheep, (*Ovis montana*, Cuv.) from E. Wasserman. Two specimens of Crustaceans, from San Francisco Bay, presented by Henry Chapman.

Mr. A. W. Chase read the following on the artesian wells of Los Angeles County:

On the Artesian Wells of Los Angeles County.

BY A. W. CHASE.

The subject of water in sufficient quantity to irrigate land for the purposes of cultivation of the cereals on an extended scale, as well as fruit trees and vines, is one of great importance to the inhabitants of that portion of California known as the semi-tropical. The uncertain quantity of the rainfall and the recurrence of droughts every few years, renders any extended cultivation of the soil impossible without recourse to artificial means of procuring and storing water.

The plains of Los Angeles county, which form the most considerable portion

of its area, slope gradually from the sea coast northward to the foot-hills of the Sierra Madre. This mountain range rises abruptly from the plain to a height approximating 10,000 feet; and is distant about forty miles from San Pedro Bay.

The general trend of the coast line, as well as of the Sierra, is east and west. During the winter season the highest points of the Sierra are covered with snow.

Even during a dry season, the quantity of water brought down from this extensive water-shed is great; the three principal rivers which carry it off, viz: the New and Old San Gabriel, and the Santa Ana, being swollen into torrents. During the summer, however, these streams dwindle into rivulets, frequently sinking in their sandy beds and becoming lost before reaching the sea.

The gardens and orchards of Los Angeles are watered from a ditch cut from the Los Angeles river, a branch of the San Gabriel; and the vineyards of Anaheim derive their supply in a similar manner from the Santa Ana. This supply is, however, even at the present time, limited, and should these towns grow to any considerable size, other means will have to be devised.

Artesian well borings were commenced some years since. They have been a success, according to my observation, only in a narrow belt extending across the plain in a direction parallel with the coast line and the mountain range.

In presenting the few facts which I have gathered, I wish more particularly to invite attention to the subject by others better informed, than to present any theory of my own.

Lying immediately on the coast line of Los Angeles county are a succession of isolated hills. The principal of these, San Pedro Hill, lies west of Wilmington, and attains an altitude of 1,473 feet. The first east of Wilmington, and down the coast, is Los Cerritos, 355 feet; the second, Landing Hill, 63 feet; the third, the Bolsas Chica, 61 feet, and the fourth, the Bolsas Grande, 119 feet. At the base of these hills, east of Wilmington, are strong springs of soft water, which may be called natural artesian wells.

The most remarkable of these is at the rancho or farm house of the Alamitos. It is a circular opening, about five feet in diameter. The water comes up in considerable force, the center of the spring being at times several inches above the edges.

The temperature of the water is 64° Fahr., being almost undrinkable when taken from the spring. It brings up in suspension particles of mica and sand.

Similar springs are found at the Bolsas Chica and the other small hills, the temperature of the water being the same in all, and corresponding with that of the artesian wells.

Thirteen miles from the sea coast is located the town of Anaheim. Here an artesian well was sunk to a depth of 200 feet through sand and clay, finally encountering a bed of boulders. Here the work was stopped, no water having been obtained. A well was sunk near the town of Wilmington, to a depth of over 400 feet, without success. Half way between the town of Anaheim and the sea coast, lies the hamlet or town of Westminster. Here some 34 artesian

wells have been bored, all of which are now flowing. These wells supply sufficient water for the use of the thirty-four families comprising the settlement, and for the irrigation of their land, which, previously of little value, has now considerably enhanced in price.

As these wells are similar in character, a description of two of them will suffice:

No. 1. Well on farm of Mr. Edwards, five miles from the sea. Well 171 feet deep. Pipe projects 2½ feet above surface. Water flows three inches above the edge of the pipe. Temperature of the air at time of observation, 71° Fahr., and of water, 64°. Water soft, and brings up mica and sand in suspension. The pipe is of the ordinary character, viz: Seven inches in diameter and one sixteenth of an inch in thickness, and is double all the way down, the outside pipe being one thirty-second of an inch larger than the inside, in diameter. The pipe is forced down in sections of eight feet.

The following strata were passed through in boring:

Sand and loam	3	feet.
Tough blue clay	23	"
Alternate layers of clay and sand	67	"
Stiff blue clay	40	"
Quicksand and fine gravel	38	"
Total	171	"

At the depths of 140 and 150 feet, holes 1½ inches long, and one-sixteenth of an inch wide, were pierced in the pipe, through which the water enters from the strata of quicksand. The water from this well irrigates 160 acres.

No. 2. Stevens' well. This well is 94 feet deep, and is situated about eight miles from the sea. The pipe projects 3 feet above the ground, and the water flows over the pipe 1½ inches. Temperature of water at time of observation, 65° Fahr.; of the air, 69°. Water similar in character to the Edwards' well, and also bears mica and sand in suspension. This well passes through—

Heavy loam	10	feet.
Pliable blue clay	7	"
Alternate layers of sand and clay	61	"
Gravel (with water)	5	"
Tough clay and cement	10	"
Quicksand	1	"
Total	94	

The other wells resemble these closely, the water being of the same temperature and only flowing to the surface after the layer of tough blue clay or cement had been penetrated and the strata of quicksand reached. This strata was found at varying depths of 90 to 180 feet.

Between the town of Wilmington and Los Angeles is situated the settlement known as Compton. Here are a number of flowing wells. One of these, bored

through 85 feet of sand and clay, struck the quicksand at that depth, through which it was continued 10 feet further. This well was piped up 12 feet above the surface, the water then rose four feet above the pipe.

Other wells here are of the same character, the temperature of the water being between 64° and 65° Fahr., and presenting the same characteristics as the wells at Westminster.

Going from Compton towards Wilmington a ridge is passed, beyond which no water has been struck, although at the base of Dominguez Hill several natural artesian outflows occur.

At the settlement of Los Nietos, lying between Los Angeles and Anaheim, flowing wells have also been obtained. The borings passed through the same strata and the water is similar in character to that of the wells at Compton and Westminster.

By reference to the county map, you will see that this artesian water has been struck in a line parallel with that of the mountain ranges and the coast, but cutting the water courses at right angles.

The question is, does a subterranean basin exist under these plains, fed by the rainfall in the mountains, which finds its way in through crevices in the foot-hills, and is confined in place by the strata of clay and cement, discharging its surplus through the springs or natural artesian wells on the coast? Or is there a subterranean river, running through a bed of quicksand, filling what was perhaps an old cañon or barranca, and having spurs or offshoots to the natural springs mentioned, but emptying its main volume of water under the sea?

Since the boring of these wells no sensible diminution has been noticed in their flow, nor has the volume of water lessened in the natural springs.

Were some definite idea formed of the character and extent of this subterranean water, so that boring might be prevented in localities where no water will be found, it would be of great benefit to the people of these counties.

If, also, a careful record were kept of the number, position and average flow of the wells from year to year, it would go far towards proving whether the supply could be diminished by an increased number of wells, and whether this means of obtaining water could be depended on for the cultivation of the soil on a large scale.

Mr. S. C. Hastings read a paper upon the action of frost on grape vines, and certain apparent eccentricities in its action, in injuring vines in portions of Napa county, while others similarly situated, and directly adjoining, were comparatively uninjured. All of the vines were of foreign varieties, and those unaffected by the frost were trained to willow-stakes two and a half feet above the ground; the others were not so trained. The subject was further discussed by Messrs. Dameron and Hastings.

Regular Meeting, July 7th, 1873.

President in the Chair.

Twenty-nine members present.

F. A. Bishop, John C. Robinson, George H. Mendell, F. A. Miller, and O. Button, were elected resident members; William S. Chapman was elected a life member; and J. W. Glass, of Denver City, Colorado, a corresponding member.

Donations to the Library: Washington Catalogue of Stars, 1845–71, from U. S. Naval Observatory. Smithsonian Contributions to Knowledge, Vol. XVIII. Compendium of the Ninth Census of the U. S., 1870. Engineering and Mining Journal. Odd Fellows' Lib. Assoc., 17th and 18th Ann. Rep's. Monatsbericht der Königl. Preuss. Akad. der Wissenschaften zu Berlin, Jan., 1873. Proceedings Acad. Nat. Sci. of Phila., Jan. and Feb., 1873; also pp. 233–248, 1873, of same Proceedings. Am. Jour. of Science and Arts, June, 1873. Am. Naturalist, June, 1873. Quarterly Journal of Geolog. Society of London, Vol. XXIX, No. 114. Cal. Horticulturist, June, 1873. Annalen der Physik und Chemie, No. 3, Leipzig, 1873. Overland Monthly, July, 1873.

Additions to Library by Purchase: Cosmos di Guido Cora, II, Turin, 1873. Nature, Vol. 8, Nos. 184–189. Annals and Mag. Nat. Hist., London, June, 1873. Astronomical Register, London, June, 1873. Weigmann's Archive für Naturgeschichte, Berlin, 1873. The Journal of Botany, London, May and June, 1873. Popular Science Monthly, July, 1873.

Donations to Museum: Specimens of a species of *Virgularia* from San Diego, by Henry Hemphill. Specimens of rocks from near San Francisco, presented by C. B. Turrill. Egg case of a species of Skate, from J. P. Dameron. Tarantula and Tarantula nest from Mexico, presented by W. J. Fisher. Specimen of Duck (*Harelda glacialis* Leach) from Arctic America, presented by W. G. Blunt. Specimens of mounted birds: Sharp-shinned Hawk (*Accipiter fuscus*), Blue-winged Teal (*Querquedula discors*), Avoset (*Recurvirostra Americana*), Green black-cap Flycatcher (*Myiodioctes pusillus*), and a species of Graculus (*G. Carbo*), presented by E. F. Lorquin.

Mr. Stearns remarked that he had not determined whether the species of Virgularia presented by Mr. Hemphill was new, or the same as previously described by Mr. Gabb.

The following paper in behalf of Mr. Edwards was submitted by the President:

Pacific Coast Lepidoptera.—No. 1. Description of some new or imperfectly known Heterocera.

BY HENRY EDWARDS.

Fam. SPHINGIDÆ.

Genus SPHINX.

Sphinx perelegans, n. sp.

Head pale, silvery gray, black on occiput. Thorax with the tegulæ and sides gray; disc velvety black, uniting with the black on upper side of head, and forming, when viewed from above, a long, triangular patch; centre of thorax gray at the base. Abdomen dark gray, sprinked with black, with narrow black dorsal line. The five basal segments are equally divided into black and white demi-bands, the black being very intense and glossy. Under surface of thorax gray, with central interrupted black line. Antennæ white above, dark gray beneath. Tibiæ grayish brown, with tarsi paler.

Primaries, fuscous with many paler waved lines, and a whitish space reaching from the base over half-way along the costa, but not extending to its edge. Resting upon this pale space are five bent black lines of unequal length, and a bent line at the apex reaching to the tip. Along the margin, from internal angle to apex, is a pale submarginal band, very faintly dentate externally, running parallel with the margin until it reaches the apex, where it spreads into a wider space, receiving the before-mentioned bent apical line. At the base of interior margin is a clouded black patch. The fringes are brownish black, dotted on their edges with six conspicuous white patches, which do not, however, entirely cross the fringe. The whole of the fringe on the interior margin is brownish black.

Secondaries, black, with brownish tinge; a broad, whitish band at the base, widest posteriorly; a narrow grayish-white band crossing the wing obliquely, almost parallel with the margin, but slightly bent a little behind the middle. Fringes white, intersected with brown. (Coll. Hy. Edw.)

Expanse of wing, 3.64 inch.

Length of body, 1.52 inch.

Gilroy, Santa Clara County, Cal. G. R. Crotch, Esq.

This beautiful specimen closely resembles *Sp. eremitus*, Walk., of the Atlantic States, but is readily known by its more brilliant gray coloring, by the very sharply defined demi-bands, and by the strongly marked whitish submarginal band of the fore-wings.

Sphinx oreodaphne, n. sp.

Head wanting in my specimen.

Thorax pale, ashy gray, slightly sprinkled with black hairs, and with a well-defined triangular black mark, the vertex of which rests on the prothorax, its

sides reaching to and joining the basal black demi-band of the abdomen. The area inclosed by the triangle is pale gray. Abdomen, above, gray sprinkled with black, with narrow black dorsal line, and seven demi-bands of rich velvety black, the basal one becoming almost circular in form, and uniting with the triangular mark on the thorax. Thorax and abdomen, beneath wholly pale gray, as also are the legs, the tarsi being very faintly sprinkled with black.

Primaries, wholly pale gray, with narrow black longitudinal lines, only slightly bent, the two largest resting on the centre of the median nerve. Along the posterior margin is a whitish, irregular, submarginal band, not reaching to the internal angle.

Secondaries, blackish fuscous, with two undulating whitish bands, the outer one not quite reaching to the apex. Fringes of primaries brownish, sprinkled with gray; those of the secondaries white, very indistinctly mottled with brown. (Coll. Hy. Edw.)

Expanse of wings, 3.40 inch.

Length of body, 1.50 inch.

Taken on the wing, about flowers of California Laurel (*Oreodaphne Californica*), near St. Helena, Napa County, in June, 1872. A strongly marked species, readily distinguished by its pale fore-wings, and by the triangular mark of the thorax. The head was, unfortunately, broken from my unique specimen before it reached my hands.

Sphinx Sequoiæ, Boisduval, Lepid. Calif., 1869.

Head and thorax light gray, sprinkled with black, with two indistinct black lines on the occiput, reaching to prothorax, and thence spreading toward the sides of the tegulæ. Abdomen gray, with black dorsal line. The segments are whitish at their base, the five posterior with a black sub-linear patch on their outer edges. Antennæ white above, gray beneath. Feet wholly gray, spotted with black.

Primaries, gray, indistinctly dotted with black, with four or five very faint black lines, the longest near the apex. Fringes grayish brown, intersected with white.

Secondaries, grayish fuscous, entirely without bands. The fringes are white intersected with brown, except toward anal angle, where they are wholly whitish.

Expanse of wings, 2 inches.

Length of body, 1 inch.

(Coll. Bois., Hy. Edw.)

Grass Valley, M. Lorquin. Bear Valley, Sier. Nevada, H. E.

I had the good fortune to take a fine ♂ of this rare species in Bear Valley, in June, 1872. It was hovering at mid-day over a pool of water, darting down occasionally to drink. The specimen from which Dr. Boisduval made his description was captured by the late M. Lorquin, at Grass Valley, resting on the bark of a Redwood tree, (*Sequoia sempervirens*—Lamb.)

Sphinx Vancouverensis, n. sp.

Head dull gray, brownish on the occiput, and sprinkled with brown hairs. Eyes dull black, surrounded by a blackish ring of hairs. Tegulæ wholly cinereous. Abdomen blackish gray, with narrow black dorsal line, and six rather broad demi-bands of dirty white, blackish on the posterior margins of segments. Thorax and abdomen, beneath dull brownish gray.

Primaries, fuscous, with a grayish spâce running from base to about half way along the middle of wing, and an irregular submarginal band from internal angle to apex, the outer edge of which is deeply dentate. Near the median nerve are three straight black dashes, and a bent one toward the apex. Fringes brown, sprinkled with gray.

Secondaries, fuscous, with two dull whitish bands, slightly waved, the outer one parallel with the margin of the wing for three-fourths of its distance.

Expanse of wing, 3.55 inch.

Length of body, 1.50 inch.

Esquimault, Vancouver Island. (1 ♂ Coll. Hy. Edw.)

Taken in August, 1871, by Dr. Bremner, of H. M. S. Zealous.

Fam. ZYGÆNIDÆ.

PSEUDALYPIA, nov. gen.

Head small, front very long, densely pilose. Clypeus very long, smooth, triangular, notched on each side in front, and, when viewed from above, concealing the palpi, which are short, pilose, the third joint longest, the whole palpus straight, and shorter than the head. Antennæ simple, not thickened as in Alypia. Eyes small, not prominent. Tongue more than half as long as the body. Thorax pilose, the hairs of patagia especially long. Abdomen short, stout, covered with close, glossy pubescence. Abdominal tuft long. Wings short and broad.

Primaries, with apical angle much rounded. The nervules are very thick; neuration similar to Alypia.

Secondaries ample, very much rounded, especially toward the anal angle. Fringes of both wings very long. Legs long, only slightly pilose, wanting the bunches of hair observable in Alypia; hind pair with two very nearly equal pairs of spines, terminal pair very slightly the shorter.

This genus differs from its near ally, Alypia, by the longer tongue, shorter palpi, stouter and more glossy abdomen, simple antennæ, and by the absence of the dense tufts of hair on the fore tibiæ. The system of coloration is also essentially different; as in Alypia it consists of a series of spots variously arranged, while in the present genus it forms a simple band, crossing the fore-wings near the middle.

Pseudalypia Crotchii, n. sp.

Head, thorax, patagia, and abdomen, deep glossy black, with a slight bronze tinge. Collar, base of palpi, and abdominal tuft, golden orange. Antennæ

glossy black, with short scales. Palpi, black above, golden orange beneath. Feet wholly black, with some small white patches arranged in circular form on the hind tarsi.

Primaries, glossy black, with a greenish metallic tinge. The costa, for about three fourths of its length, and a narrow, slightly curved band crossing the wing beyond the middle, cream white. Apical edge of fringe white, the remainder glossy black.

Secondaries, dull black, with a slight brownish hue. Fringe cream white, except toward the anal angle, where it is black. Under side similar to the upper, with the band of primaries more broadly defined, and with a whitish tinge toward their base. (2 ♀ Coll. Hy. Edw.)

Expanse of wings, 0.85 inch.

Length of body, 0.35 inch.

Warner's Ranch, San Diego, Cal., May 8, 1873.

This exquisite insect was discovered by my friend, Mr. G. R. Crotch, whose enthusiastic labors have added so much to our knowledge of the insect fauna of California, and to whom I regardfully dedicate the species. It was flying in the heat of the day, alighting frequently on flowers, and manifesting much the same habits as the various species of Alypia.

Genus Ctenucha. Kirby.

Ctenucha Walsinghamii, n. sp.

Size and aspect of *C. multifaria*.

Head, collar and patagia bright crimson, the latter narrowly edged with black, as in *C. multifaria*; palpi also crimson, with the terminal article black. Antennæ long, bluish black, closely bipectinate. Thorax with the disc greenish black. Abdomen very glossy, bluish black, with a faint greenish tinge. Legs bluish black, with the anterior coxæ distinctly white. Fore tibiæ with a few white scales.

Primaries, bluish black, with a greenish tinge, most vivid toward the base. Costal edge entirely dull black. Fringe white at apices, the remainder black.

Secondaries, bluish black, with a purple tinge. Fringe white at apices, rest entirely black.

Expanse of wings, 1.90 inch.

Length of body, 0.60 inch.

Fort Crook, Oregon, June, 1872. (1 ♂ Coll. Hy. Edw.)

I owe the possession of this beautiful specimen to Lord Walsingham, who found it in the above locality during his recent tour through Southern Oregon, where it appears to be very rare. At first sight, this species may be confounded with *C. multifaria*, but differs in having the costa entirely black, and the apices of the wings *only* with white fringe.

Fam. EPIADIDÆ.

Genus Epialus. H. G.

Epialus modestus, n. sp.

Head, thorax, and abdomen dull fawn color; thorax with rather long hairs

Eyes black. Feet chestnut, with long hairs. Primaries, wholly fawn colored; scales thinly scattered over the surface, a few of them having a reddish tinge.

Secondaries, pale fuscous, fawn color at the base.

Expanse of wings, 0.60 inch.

Length of body, 0.28 inch.

(1 ♂ Coll. Hy. Edw.) San Miguel, Cal., April, 1873.

The smallest species of the genus yet known to me. It was taken at rest in the flowers of *Compositæ*.

LIST OF SPECIES.

Sphinx perelegans, n. sp.	Gilroy, California.
" *Oreodaphne*, n. sp.	S. Helena, California.
" *Vancouverensis*, n. sp.	Esquimault, Vancouver Island.
" *Sequoiæ*, Bois.	Bear Valley, California.
Pseudalypia (n. gen.) *Crotchii*, n. sp.	Warner's Ranch, California.
Ctenucha Walsinghamii, n. sp.	Fort Crook, Oregon.
Epialus modestus, n. sp.	San Miguel, California.

Professor Davidson said that having been disappointed in not receiving the drawings for his improvement on the telemeter, he would review what had been done on the subject by the various inventors to date. He explained the methods available, and the accuracy of those in use on the Coast Survey, where the chain was almost abandoned in filling in the details of topographical work. He said that the land surveys of the United States, especially in the hilly sections, could be done with greater rapidity, and far greater accuracy, by the Coast Survey methods and instruments, than by those yet in use. The great object of military and civil engineers has been to determine the distance of an object by means within the instrument itself; this has been partially accomplished, and the proposed improvement is believed to be another step forward.

Aboriginal Shell Money.*

BY ROBERT E. C. STEARNS.

Of the numerous objects or substances which exist in a natural state, and which require little or no mechanical preparation for adaption for use as money, the shells of many of the marine *mollusca*—or shell-fish, so called—furnish at once an excellent and appropriate material. Where the metals do not exist, or the knowledge of manipulating them is wanting, no substance or form can be named which is at once so available and convenient. Thus we find that certain

* See also *Overland Monthly* for October, 1873.

forms of shells have been used by the aborigines of both shores of our own continent; and, though the forms used by the Indians of the Atlantic Coast were quite different, according to the authors whom we have consulted, from that of the money of the West American tribes, yet this can not be accounted for on the supposition that a similar form is not found on the Atlantic Coast, for such is not the fact. It is not unreasonable to suppose that they had but little, if any, knowledge of each other, and more likely none at all. Being separated by the breadth of a continent, with many wide and rapid rivers and several lofty mountain ranges intervening, and the intermediate country occupied by numerous and distinct tribes quite as jealous of any invasion of their territory as are the civilized nations of to-day, the use or the knowledge of the use of any substance or particular form for money by the tribes of either coast, was probably unknown to those of the opposite trans-continental shore.

The Pilgrim settlers of the Massachusetts Colony at Plymouth found a form of money in use among the Indians of New England; and in the Historical Collections of Massachusetts, and from other sources as recorded by Governor Winthrop and Roger Williams, we are informed as to its character and substance. One of the most common bivalve mollusks (clams) of that coast is the *Venus mercenaria*, or *Mercenaria violacea*, (Plate VI, fig. 1,) as it is now called by naturalists; it is the "hard-shell clam" of the New York market, and in the markets of Boston is known as the "quahog." The valves or shells of this species frequently display an interior purple edge—varying in this respect, it is said, in different localities—the rest of the shell being of a clear white. From the darker colored portion the Indians made their purple money, or *wampum*, as it was called; while from the axis of a species of *Pyrula* or conch, and from other shells, they made their white money, or white *wampum*. In reference to the first shell, and its use as a substance from which the *wampum* was made, we have the following: "The quahaug (*Venus mercenaria*), called by Roger Williams the *poquau* and the *hen*, is a round, thick shell-fish, or, to speak more properly, worm. It does not bury itself but a little way in the sand; is generally found lying on it, in deep water; and is gathered by rakes made for the purpose. After the tide ebbs away, a few are picked up on the shore below high-water mark. The quahaug is not much inferior in relish to the oyster, but is less digestible. It is not eaten raw; but is cooked in various modes, being roasted in the shell, or opened and broiled, fried, or made into soups and pies. About half an inch of the inside of the shell is of a purple color. This the Indians broke off and converted into beads, named by them *suckauhock*, or black money, which was twice the value of their *wampom*, or white money, made of the *metauhock*, or periwinkle (*Pyrula*).*

"As to the derivation of the word 'quahog,' Governor Winthrop refers to it as '*poquahauges*, a rare shell and dainty food with the Indians. The flesh eats like veal; the English make pyes thereof; and of the shells the Indians make money.' He says of the money, 'It is called *Wampampeege*. † Also,

* Massachusetts Historical Society's Collections, VIII, 192 (1802).

† Journal Royal Society, June 27, 1634.

called by some English *hens-po-qua-hock*; three are equal to a penny; a fathom is worth five shillings.' *

"*Poquahock*, corrupted into *quahaug* or *quahog*."

The money or *wampum* made from the shells above referred to, was not only in use among the Indians, but among the Whites also. Col. T. W. Higginson, of Massachusetts, in one of his *Atlantic Essays*, "The Puritan Minister," says: "In coming to the private affairs of the Puritan divines, it is humiliating to find that anxieties about salary are of no modern origin. The highest compensation I can find recorded, is that of John Higginson, in 1671, who had £160 voted him in 'country produce,' which he was glad, however, to exchange for £120 in solid cash. Solid cash included beaver-skins, black and white *wampum*, beads and musket-balls, value one farthing."

In Cadwalader Colden's *History of the Five Indian Nations* (p. 34), he says that *wampum* is made of the large whelk-shell *Buccinum*, and shaped like long beads; it is the current money of the Indians. Whether the shells of the true *Buccinum* (*B. undatum*, Linn., or *B. undulatum*, Mull.), or those of *Busycon* (*B. canaliculatum* and *B. cartca*), is not satisfactorily explained.

In Major Rogers' *Account of North America* (London 1765), in alluding to the *wampum* of the Indians, he says: "When they solicit the alliance, offensive, or defensive, of a whole nation, they send an embassy with a large belt of *wampum* and a bloody hatchet, inviting them to come and drink the blood of their enemies. The *wampum* made use of on these and other occasions, before their acquaintance with the Europeans, was nothing but small shells, which they picked up by the sea-coast, and on the banks of the lakes; and now it is nothing but a kind of cylindrical beads, made of shells, white and black, which are esteemed among them as silver and gold are among us. They have the art of stringing, twisting, and interweaving them into their belts, collars, blankets, moccasins, etc., in ten thousand different sizes, forms, and figures, so as to be ornaments for every part of dress, and expressive to them of all their important transactions.

"They dye the *wampum* of various colors and shades, and mix and dispose them with great ingenuity and order, so as to be significant among themselves of almost everything they please; so that by these, their words are kept and their thoughts communicated to one another, as ours by writing. The belts that pass from one nation to another in all treaties, declarations, and important transactions, are very carefully preserved in the cabins of their chiefs, and serve not only as a kind of record or history, but as a public treasure."

Colden is the only author in whose writings we find any allusion to the use or manufacture of money or *wampum* by any of the *interior* tribes, and the tribes of the Five Nations were not remote from the Atlantic shore.

How far to the south of New England this *wampum* money was used, we do not know. The shells of which it was made are abundant in the neighborhood of New York and Philadelphia, and are the common clam in the markets of those cities. A closely related form (*Mercenaria præparca*, Say), is found on the shores of Florida, and attains an exceedingly large size; specimens collected in

* Vide *Invertebrata of Massachusetts*, Binney's edition, p. 134.

Tampa Bay frequently weigh as much as three and a half pounds after the animal is removed. Explorations made by us in that State in the year 1869, in the course of which many of the ancient shell-heaps and burial-mounds on both shores of the peninsula were examined, resulted in the obtainment of much interesting material, but no specimens were found of forms which suggested their possible use for money.

Crossing the continent to the north-western coast of North America, we find that the sea-board aborigines had, and in a decreasing degree still use, a money of their own—a species of shell, though of a widely different form from that used by the natives of the Atlantic coast. The money of the West-coast Indians is a species of tusk-shell (*Dentalia*), resembling in miniature the tusks of an elephant, (Plate VI, fig 2). Mr. J. K. Lord, formerly connected, as naturalist, with the British North American Boundary Commission, refers to the use of these shells as money "by the native tribes inhabiting Vancouver's Island, Queen Charlotte's Island, and the main-land coast from the Straits of Fuca to Sitka. Since the introduction of blankets by the Hudson's Bay Company, the use of these shells has to a great extent died out; and the blankets have become the money, as it were, by which everything is now reckoned and paid for by the savage. A slave, a canoe, or a squaw, is worth in these days so many blankets; it used to be so many strings of *Dentalia*." Mr. Lord also remarks: "The value of the *Dentalium* depends upon its length. Those representing the greater value are called, when strung together end to end, a *Hi-qua;* but the standard by which the *Dentalium* is calculated to be fit for a *Hi-qua* is that twenty-five shells placed end to end must make a fathom, or six feet in length. At one time a *Hi-qua* would purchase a male slave, equal in value to fifty blankets, or £50 sterling.*

Mr. Frederick Whymper, speaking of an Indian muster of various tribes at or near Fort Yukon, Alaska, in 1867, says: "Their clothing was much befringed with beads, and many of them wore through the nose (as did most of the other Indian *men* present) an ornament composed of the *Hya-qua* shell (*Dentalium entalis*, or *Entalis vulgaris*). Both of the fur companies on the river trade with them, and at very high prices. These shells were formerly used, and still are, to some extent, as a medium of currency by the natives of Vancouver Island and other parts of the North-west Coast. I saw on the Yukon, fringes and head-ornaments, which represented a value in trade of a couple of hundred marten-skins.† Mr. Whymper further remarks that "These shells are generally obtained from the west coast of Vancouver Island," and that his spelling "*Hya-qua* conveys a "closer approximation to the usual pronunciation of the word" than Mr. Lord's "*Hi-qua*."

The use of these shells for nasal ornamentation by the Indians, as observed by Mr. Whymper at Fort Yukon, attracted our attention while at Crescent City, in this State, in the year 1861. A medicine-man, belonging to one of the neighboring tribes, had perforated the partition which separates the nostrils, and, into

* Proceedings Zoological Society, London, March 8th, 1864.

† Whymper's *Alaska*, Harper's edition, 1869, p. 255.

the hole thus made, had inserted from each side, point by point, two of these shells, which decoration was further increased by sticking a feather of some wild-fowl into the large end of each of the hollow shells.

As to the length of the shells, as implied by Mr. Lord's statement "that twenty-five shells placed end to end must make a fathom or six feet," we are inclined to believe there is some mistake, as the shells would have to average very nearly three inches in length. Of the great number which we have seen of the species mentioned by Lord and Whymper (*Dentalium entalis*, or *Entalis vulgaris*), but very few attain a length of two inches; the great majority averaging much less. As to the specific names of the shells used as above, and the localities from which they are obtained, it may be well to state that the "west coast of Vancouver Island" form is the *Dentalium Indianorum** of Dr. P. P. Carpenter; but probably the greater part of the tusk-shells which are or have been in circulation, do not belong to the American species, but to the common European *Dentalium*,† referred to by the gentleman, and which closely resembles the American. The foreign species has been extensively imported for the Indian trade, and we have noticed at different times large numbers of the imported shells displayed for sale in the fancy goods stores in San Francisco, together with beads and other Indian goods. The use of the *Dentalia* for money among the Alaskan tribes is also corroborated by Mr. W. H. Dall, whose extensive travels and thorough investigations in that territory are well known. It is highly probable that the use of these shells in that region will soon become a story of the past, and the money of the Pale-faces will supersede among the Redmen the shells of the sea.

The Indians of California, or the tribes inhabiting the northern portion of the coast and the adjoining region, also use the tusk-shells for money; either the shells or the shell-money is called *alli-co-cheek*, or *allicochick*—the latter being the orthography, according to Mr. Stephen Powers, whose valuable papers upon "The Northern California Indians," in the *Overland Monthly*, are an important contribution to American aboriginal history.

"For money, the Cahrocs make use of the red scalps of woodpeckers, which are valued at $5 each; and of a curious kind of shell, resembling a cock's spurs in size and shape, white and hollow, which they polish and arrange on strings, the shortest being worth twenty-five cents, the longest about $2—the value increasing in a geometrical ratio with the length. The unit of currency is a string the length of a man's arm, with a certain number of the longer shells below the elbow, and a certain number of the shorter ones above. This shell-money is called *allicochick*, not only on the Klamath, but from Crescent City to Eel River, though the tribes using it speak several different languages. When the Americans first arrived in the country, an Indian would give from $40 to $50 in gold for a string of it; but now it is principally the old Indians who value it at all." ‡

* Supp. Rep. Brit. Ass'n, 1863, on Mollusca of W. N. America, p. 648.

† *Antalis entalis*, *Vide* Adams' *Genera*, vol. I, p. 457.

‡ *Vide Overland Monthly*, vol. VIII, pp. 329, 427, 535.

In speaking about marriage among the Eurocs, he says: "When a young Indian becomes enamored of a maiden, and cannot wait to collect the amount of shells demanded by her father, he is sometimes allowed to pay half the amount, and become what is termed 'half married.' Instead of bringing her to his cabin and making her his slave, he goes to live in *her* cabin and becomes *her* slave." Again, he says: "Since the advent of the Americans, the honorable estate of matrimony has fallen sadly into desuetude among the young braves, because they seldom have shell-money now-a-days, and the old Indians prefer that in exchange for their daughters.... (The old generation dislike the white man's money, but hoard up shell-money like true misers)," etc. Among the Hoopas, "murder is generally compounded for by the payment of shell-money." *

In connection with the use of money in traffic among the interior Indians, it appears that "all the dwellers on the plains, and as far up on the mountain as the cedar-line, bought all their bows and most of their arrows from the upper mountaineers. An Indian is about ten days in making a bow, and it costs $3, $4, or $5, according to the workmanship; an arrow, 12½ cents. Three kinds of money were employed in this traffic. White shell beads, or rather buttons, pierced in the centre and strung together, were rated at $5 per yard; periwinkles, at $1 a yard; fancy marine shells at various prices from $3 to $10, or $15, according to their beauty." †

The shell-money here referred to is not sufficiently particularized to admit of a determination of the species to which the shells belonged. In connection with the treatment of the sick among the Meewocs, Mr. Powers says: "The physician's prerogative is, that he must always be paid in advance; hence, a man seeking his services brings his offering along—a fresh-slain deer, or so many yards of shells, or something—and flings it down before him without a word, thus intimating that he desires the worth of that in medicine and treatment. The patient's prerogative is, that if he dies, his friends may kill the doctor."‡

Among the Moädocs, or Modocs, "when a maiden arrives at womanhood, her father makes a kind of a party in her honor. Her young companions assemble, and together they dance and sing wild, dithyrambic roundelays, improvised songs of the woods and the waters:

"'Jumping echoes of the rock;
Squirrels turning somersaults;
Green leaves, dancing in the air;
Fishes white as money-shells,
Running in the water, green, and deep, and still.
Hi-ho, hi-ho, hi-hay!
Hi-ho, hi-ho, hi-hay!'

This is the substance of one of the songs, as translated for me." §

Among the Yocuts, another California tribe, whose dominion covers "the Kern and Tulare basins, and the middle San Joaquin," etc., "their money consists of the usual shell-buttons, and a string of them reaching from the point of

* *Overland Monthly*, vol. IX, p. 156.
† *Id.*, vol. X, p. 325.
‡ *Id.*, vol. X, p. 327.
§ *Id.*, p. 541.

the middle finger to the elbow is valued at twenty-five cents. A section of bone, very white and polished, about two and a half inches long, is sometimes strung on the string, and rates at a 'bit.' They always undervalue articles which they procure from Americans. For instance, goods which cost them at the store $5, they sell among themselves for $3." *

We have no authentic *data* as to whether the value of the shell-money, properly so-called, among the California Indians, and those farther north, was graduated by the color, or whether they generally used other than the *hya-qua* or *allicochick* (*Dentalia*), which are white and have a shining surface; for though, as above, "periwinkles" and "fancy marine-shells" are mentioned as used in trade, these may have been regarded more as articles of ornamentation, and esteemed among the interior Indians particularly as precious, the same as diamonds and fine jewelry are among civilized people. In this view, the interior Indians of California are probably not unlike the more southern Indians of New Mexico, for a friend of ours (Dr. Edward Palmer of the Smithsonian Institution) informed us a few years ago, that while traveling in that territory he was witness to a trade wherein a horse was purchased of one Indian by another, the price paid being a single specimen of the pearly ear-shell (*Haliotis rufescens*), or common California red-back *abalone* or *aulon*.

As to the value of the tusk-shells among the California Indians, the method of reckoning the same is by measuring the shells on the finger-joints, the longest being worth the most.

We have been informed that the Indians who formerly resided in the neighborhood of the old Russian settlement of Bodega, used pieces of a (bivalve) clam-shell (*Saxidomus aratus*†) for money, but we have been unable to obtain a specimen, or to verify the statement. Recently, our friend Mr. Harford, of the Coast Survey, has discovered in some Indian graves, on one of the islands off the southerly coast of this State, beads, or money, of a different character from any heretofore observed. These were made by grinding off the spire and lower portion of a species of univalve shell (*Olivella biplicata*, Sby., Plate VI, Fig. 3), so as to form small, flat, button-shaped disks with a single central hole. These much resemble in form some of the *wampum* of the New England tribes. Another variety was found in the same places by the gentleman named, which was made of a species of key-hole limpet-shell (*Lucapina crenulata*, Sby., Plate VI, Fig. 6), of much larger size than that first mentioned. So far, however, as we have investigated, these last described forms of shell-money are not in use among the California Indians of the present day. Plate VI, Figures 6^a and 6^b represent beads or money made from *Lucapina*.

The use of shells for money is not peculiar to the natives of North America. The well-known and exceedingly common money *courry* (*Cypræa moneta*, Plate VI, Figs. 5, and 5^a) or "prop-shell," an inhabitant of the Indo-Pacific waters, "is used as money in Hindostan and many parts of Africa.... Many tons are ....imported to.... Great Britain and....exported for barter with the native tribes of western Africa." ‡

* *Overland Monthly*, vol. II, p. 108. † S. aratus+S. gracilis, Gld.

‡ Baird's *Dictionary of Natural History*, p. 193.

Reeve mentions in the second volume of the *Conchologia Systematica*, that "a gentleman residing at Cuttack, is said to have paid for the erection of his *bungalow* entirely in these *cowries* (*C. moneta*). The building cost him about 4,000 *rupees sicca* (£400 sterling), and, as sixty-four of these shells are equivalent in value to one *pice*, and sixty-four *pice* to a *rupee sicca*, he paid for it with over 16,000,000 of these shells."

Though the number above mentioned is very large, the prop-shell is an exceedingly abundant form. We have received in a single box from the East Indies not less than 10,000 specimens at one time. "In the year 1848, sixty tons were imported into Liverpool, and in 1849, nearly three hundred tons were brought to the same port."

The following extract from a paper by Prof. E. S. Holden, on *Early Hindoo Mathematics*,* justifies the inference that the use of the *Cypræa moneta* for money has a very considerable antiquity, and quite likely extends back to a period many centuries earlier than the date of the treatise.† "The treatise continues rapidly through the usual rules, but pauses at the reduction of fractions to hold up the avaricious man to scorn: 'The quarter of a sixteenth of the fifth of three-quarters of two-thirds of a moiety of a *dramma* was given to a beggar by a person from whom he asked alms; tell me how many cowry shells the miser gave, if thou be conversant in arithmetic with the reduction termed subdivision of fractions.'" These shells are also known as "Guinea money," and, it is said, have been used as a financial medium in connection with the African slave-trade. Doubtless many a poor negro has been sold, and has lost his liberty, for a greater or less number of these shells.

Another species of *cowry* of small size, and which inhabits the Indo-Pacific province, called the "ringed cowry" (*Cypræa annulus*), the back or top of the shell being ornamented with an orange-colored ring, "is used by the Asiatic islanders to adorn their dress, to weight their fishing-nets, and for barter. Specimens of it were found by Dr. Layard in the ruins of Nimroud."

According to the relation of a recent voyage, transactions are performed in Soudan by barter, or by means of small shells picked up in the Niger, which are called *ouldâas* or *woodahs*.‡

It will be seen, therefore, that shells have been and are still used as money by portions of the human race, but to an extent much less than formerly. It would be quite difficult to point out any other natural production which is more appropriate, when size, shape and substance are considered.

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* *Popular Science Monthly*, July, 1873, p. 337.

† "This treatise, the *Lilivati of Bhascara Acharya*, is supposed to have been a compilation, and there are reasons for believing a portion of it to have been written about A. D. 628. However this may be, it is of the greatest interest, and its date is sufficiently remote to give to Hindoo mathematics a respectable antiquity."

‡ *Science Gossip*, Dec., 1866, p. 283.

Mr. Stearns submitted the following communication for Dr. Cooper:

On the Law of Variation in the banded California Land Shells.

BY J. G. COOPER, M. D.

1. *ARIONTA Leach.*

In studying further the species referable to this genus in California, together with their geographical distribution, some curious generalizations are arrived at, hinted at in a former article by me in the American Journal of Conchology, Vol. IV, p. 211, but not then so fully understood.

The close relationship and probable identity of some assumed species has been long apparent to all who have examined them, but from paucity of specimens, or reasons by which to account for their differences, they have been allowed to retain their rank as species until more numerous intermediate forms should establish their position as varieties.*

Though these connecting links are very few, and from the peculiarly local distribution of the chief forms are not likely to be found numerous, yet I think it can be shown that these local forms are not entitled to higher rank than that of sub-species which have had a common origin. By gradual divergence from one or a few centers of distribution, and being brought under the influence of different climates, they have assumed their present conditions, which are still subject to many variations, showing a tendency to the production of other forms. The systematic arrangement of these species and varieties, or sub-species, in connection with their distribution, can be best shown by a diagram. See Plate VII.

The plan here given shows the position and extent of range of each form allied to *Arionta*, the range north and south being shown by the parallels of latitude, and that east and west by the length of the brackets enclosing or adjoining the names, which may be compared with the scale given. It will be observed that the additions to our knowledge of their range has not much increased since the publication of the map given in the Amer. Jour. of Conch., Vol. IV, p. 211, though some doubtful points have been settled.

The chief centers of distribution are around San Francisco Bay, on the Santa Barbara islands, and near San Diego, whence one species follows up the Sierra Nevada to near lat. 40°. As this species has so wide a range, and presents nearly as many varieties as are found in the other groups, it becomes a question whether it is not the (Darwinian) progenitor of those along the coast which occupy regions of later geological age. Though the group around San Francisco Bay is one hundred miles distant from the nearest of that species, it must be remembered that the rivers all converge toward the bay, and that the floods

*Most of the names in use will no doubt be always retained for convenience in distinguishing between the various races, etc.

sometimes convert the entire interval into a lake, over which the species might have been spread, and since modified in its new localities. The chief argument to the contrary may be in the fact that no specimens are known to have been lately transported in this way. The most limited local varieties are indicated by names placed horizontally, and they usually differ more than others, being also more distant geographically.

As I have hinted at the probability of *A. tudiculata* being the progenitor of the coast forms, I may remark that the fossil form found at the foot of the Sierra Nevada, by Mr. Gabb, has the very high imperforate character of specimens now living close to the coast, and may have existed in the Miocene epoch when the San Joaquin valley was an arm of the sea, in which lived the sharks, etc., whose remains now abound not far from the Helix locality. It would then have lived close to the edge of this sea, and before the greater part of the coast range was elevated above it. The transplanting of the Arionta form to the latter may have been after the salt water was replaced by fresh, or in the Pliocene epoch.

Omitting for the present a critical comparison of the species and varieties which I have made ready for future publication, I intend here to point out only the geographical reasons for the conclusions to which I have arrived, as indicated in the diagram.

Around San Francisco Bay we have three well-marked, and always separable, species, viz: *arrosa*, *exarata*, and *Californiensis*, all living together on the west side, and at nearly equal distances north and south. Rare hybrids only exist as connecting links.

The last also extends to the east side of the bay, where it produces three varieties which mix together, and also with the typical form on the west side. *Var. nemorivaga* is almost equally common on both sides, and extends further south than any, there meeting (but not mixing) with *var. vincta*, at Monterey. (I omit "*Nickliniana*," as it seems founded upon a combination of the characters of these with *tudiculata*.)

Now, all these varieties of *Californiensis* follow certain definite rules in their divergence from the typical form, according to the amount of heat, moisture, fog, and wind they are subject to. *A. arrosa* and *exarata*, having only a narrow range close to the coast, are subjected to little difference in these conditions, and accordingly vary but little. *Californiensis* and varieties, on the contrary, spreading twice as far inland, gradually change from a high, imperforate form to depressed and umbilicate, as they pass into drier and hotter regions, with so many intermediate forms that their specific identity and the causes of variation can scarcely be doubted. A similar variation, but in less degree, occurs in the two others mentioned.

The next centre of distribution for *Arionta*, is that of *tudiculata* and varieties on the west slope of the Sierra Nevada, one hundred miles east of the preceding, and separated by wide alluvial valleys, in which no specimens of *any* species have ever been found.

This species presents a series of varieties analogous to those of *Californiensis*,

but much less extreme, and scarcely definable, as they run together very closely. This is a consequence of its distribution being continuous from north to south along a mountain range, and not interrupted by alternating mountains, valleys, and bays, as is that of the preceding. It is always recognisable by fixed characters permanent through great extremes of size.

At the south end of the range of *tudiculata* we meet with another species, in range somewhat intermingled with it, but always distinct, viz: *A. Kellettii Fbs.*, which centres around San Diego Bay and the neighboring islands, from lat. 34° southward to lat. 28°, or perhaps 26°, in Lower California, four hundred or five hundred miles. The various forms found within this vast range, and which have been described as *Kellettii, redimita, Tryoni, intercisa, crebristriata*, and *Stearnsiana*, pass so insensibly from one to another that they must be considered merely varieties analogous to those of *Californiensis*. The most northern is the most different from the type which was from the most southern part of their range, but intermediate forms connect them all.

The parallel between the varieties of the two species is well shown by the following table:

A. Form elevated, imperforate. Inhabit cool, foggy exposures.

b. vincta Val.	*Tryoni Newc.*
c. nemorivaga Val.	*redimita W. G. B.*
a. CALIFORNIENSIS Lea	*KELLETTII Fbs.*

B. More depressed, perforate. From warmer localities.

d. ramentosa Gld.	*crebristriata Newc.*
e. reticulata Pf.	*intercisa Newc.*
f. Bridgesii Newc.	*Stearnsiana Gabb.*

Though of course not strictly parallel, many points of resemblance can be seen between the forms thus compared. Thus the varieties *d.* and *e.* of each have similar relations *inter se* as to sculpture, while *f* is in each very similar to the type; the "circular" arrangement being well represented in each group.

All these banded species and varieties are connected so closely together by their banded character, that a common origin in the dim periods of the past seems highly probable, and yet their parallelism with another large series existing in the same regions, but always distinguishable, indicates that some common physiological law, still unknown, is connected with this character. In the form of shell and animal, as well as in its anatomy, they seem more closely connected with the Lower Californian group embracing *areolata, Pandoræ, levis*, etc., which vary from colorless to many-banded or blotched, showing a relationship similar to that held by "*Arionta candidissima*" of Palestine to *A. arbustorum* of Europe, a species between *Californiensis* and *Kellettii*.

II. LYSINOE H. and *A. Adams.*

A comparison of the distribution of the species which I have referred to this group with that of the *Ariontas*, presents one very striking difference at first

view, namely, that the former do not occur in localized groups widely separated, but in linear series following the mountain ranges from north to south, or the chains of islands either in the same or the opposite direction. As with *Arionta*, however, a few isolated forms occur like extreme local developments of varieties, perhaps depending for their characters on local influences, though these are not always so easily understood. See Plate VIII.

Two new elements of specific distinction also occur, viz: angulation of the periphery, and more or less pilosity of the epidermis.*

I have before pointed out the apparent relation between angulation and shaly mountains, as well as between pilosity and arid climate. Though connecting links are not known between the forms showing these characters, and their nearest allies without them, (except in the case of *infumata* and *fidelis*) I am now decidedly of the opinion that they will be found between *Mormonum* and *Hillebrandi* (being already imperfectly indicated), and between *Dupetithouarsi* and *sequoicola*.† Three of these therefore will have to take rank as varieties of the others, and more such instances will doubtless occur. There is some evidence that *L. Mormonum* was the geological progenitor of the forms living near the coast, in the fact that a variety, nearly intermediate between it and *fidelis*, occurs at the Dalles of the Columbia, where *fidelis* passes eastward through the gap of the Cascade mountains. Some varieties also approach quite near *L. Traskii*, which meets it southward.

The varieties of the species of this group, corresponding to *a*, *b*, *c*, etc., of the former, are not so distinctly marked, and have not received so many distinctive names, except in the following cases:

b. *AYRESIANA Newc.*	*REMONDII Tryon.*
c. *DUPETITHOUARSI Val.*	*rufocincta Newc.*
a. *FIDELIS Gray*	*TRASKII Newc.*
d. *infumata Gld.*	*ROWELLII Newc.*
e. *MORMONUM Pf.*	*Lohrii Gabb.*
f. *sequoicola Cp.*	*Gabbii Newc.*

Those best entitled to specific rank being in capitals, it appears that the divergences of these forms are greater than in the former case.

The groups *d* and *e* are mostly flattened, angulated, and hirsute, at least when young, while *f*, as before, returns by the "circular" method toward the characters of *b*.

No certain instances of specific intergradation between members of *Lysinoe* and *Arionta* are known. Though I formerly supposed some varieties to be intermediate, or hybrids, I am now inclined to consider them instances of mimetic resemblance, as species of one group are well known to approach those of another where their geographical limits approach each other. We find, however,

L. Traskii, as well as the allied forms, is hirsute up to the size of three or four whorls in Ventura county.

† Mr. G. W. Dunn has lately found specimens of *sequoicola* very black and *without band*, though not angled like *infumata*. *Hab.*, north of Santa Cruz.

members of each living together in numerous localities throughout the range of both, without intermediate forms.

THE LAW OF VARIATION.

The biological law deducible from the preceding facts is, that those species, sub-species, and varieties living in cool, damp situations, become more highly developed (but not always larger) than the others, the shell assuming a more compact (imperforate) form, and losing those indications of immaturity referred to, viz: sharp, delicate sculpture, bristles, and angular periphery.

These characteristics, however, remain more or less permanently for indefinite periods, and give that fixedness to the various forms, even when living under the same conditions, which enables us to retain them as *sub-species*, differing from *varieties* in permanency, and from *races* in not inhabiting distinct regions. *Arionta arrosa* and *Lysinoe Dupetithouarsi* are thus the highest developed of either group in California.

The President informed the Academy that Mr. C. E. Watkins, the well-known photographer, had generously offered to make photographs, cabinet size, of all the members, and present a copy of each to the Academy, provided that they would furnish a suitable album for their preservation.

Regular Meeting, July 21st, 1873.

President in the Chair.

Thirty-six members present.

Dr. J. C. Horner de Tavel, of Oakland, and A. Gros, were elected resident members, and H. H. Moore and D. O. Mills, life members.

Donations to Library: Société des Arts et des Sciences of Batavia, Verhandelingen, Vol. XXXIV et XXXV; Tijdschrift XVIII, 1, 2, 3, XX, 1, 2; Notulen VIII, 3, 4, IX, 1871. Beitrag zur Kenntniss der Insekten-Fauna des Kantons Zürich; Käfer von Kaspar Dietrich; 4to., Zürich, 1865; from H. Erni, U. S. Consul. The Principle of Least Action in Nature, etc., etc., by the Rev. Samuel Haughton, pamph. 8vo., London, 1871; from the author. R. Comitato Geologico d'Italia, Nov. and Dec., 1872, Jan. and Feb., 1873. Rapport sur les Progres recents des Sciences Zoologiques en France, par M.

Milne Edwards; 8vo., Paris, 1867; from the author. Journal de Conchyliologie, Tome X, 1870, and Tome XI, 1871; from Messrs. Crosse and Fischer, publishers, Paris. Bulletin de la Société des Sciences Historiques et Naturelles de l'Yonne, Vol. 26, anneé 1872. Société des Arts et des Sciences of Batavia; Tijdschrift XIX, 1–6, 1869–70. Notulen VII, 2, 3, 4; VIII, 1, 2. Verhandlungen des Hist. Vereins von Oberpfalz und Regensburg, 8vo., Stadtamhoff, 1872. Crustacés divers et Poissons des depots Siluriens de la Bohême par Joachim Barrande, 8vo., Prague, 1872; from the author. Bulletin de la Société Imperiale des Naturalistes de Moscow, 1872, Nos. 2 and 3. Jahrbuch der k. k. Geolog. Reichsanstalt, Oct., Nov., and Dec., Wien, 1872. Verhandlungen der k. k. Geolog. Reichsanstalt, Nos. 12–18, Wien, 1872. Schriften der Natur-Gesellschaft in Danzig; 4to., Vol. I, Part I, Danzig, 1872. Société Entomologique de Belgique, (Bulletin) No. 78, 1872. Sitzungsberichte der K. Akad. der Wissenschaften, Erste Abtheilung, Band LXV, Heft I, II, III, IV, V; Zweite Abtheilung, Band LXV, Heft I, II, III, IV, V; Dritte Abtheilung, Band LXV, Heft I, II, III, IV, V. Wien, 1872. Denkschriften der Kaiserlichen Akad. der Wissenschaften, (Vol. XXXII) Wien, 1872. Index of Articles in Vols. 61–64 of Akademie der Wissenschaften, Wien, 1872. Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien, Band XXII, Wien, 1872. Memoires de la Société de Physique et d'Histoire Naturelle de Geneva, Tome XXI, seconde parte, 1872. Jahresbericht VIII und IX des Vereins für Erdkunde zu Dresden, Pamph. 8vo., 1872. Bericht über die Senckenbergische Naturforschende Gesellschaft, 1871–72. Sitzungsberichte der Akademie der Wissenschaften zu München, 1871, Hefte I, II, III, 1872, Hefte I, II; also, Inhaltsverzeichniss zu 1860–1870. Die Aufgabe des chemischen Unterrichts, etc., von Dr. Emil Erlenmeyer, pamph. 4to., München, 1871. Annalen der Königlichen Sternwarte bei München, Band XVIII, 1871; also, Supplement, bad XI, 1871, and XII, 1872. Jahrbücher des Nassauischen Vereins für Naturkunde, Jahrgang XXV und XXVI, 1871–72. Bulletin de la Société des Sciences Naturelles de Neufchatel, Tome IX, Deuxieme cahier, 1872. Oversight over det Kongelige Danske Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbedjder, 1871, Nov. and Dec., 1872, Jan., Febr., and March. Der Zoologische Garten, Frankfurt a. M. July–Dec., 1872. Zeitschrift der Deutschen Geol. Gesellschaft, Band XXIV, Heft 3, May, June, and July, Berlin, 1872. Zoologische Miscellen, XVI, XVII, 1872; Phylloxera vastatrix; by G. R. von Frauenfeld; from the author. Zeitschrift für die Gesammten Naturwissenschaften. Band V, VI, Berlin, 1872. Schriften der Gesellschaft zur Beförderung der gesammten Naturwissenschaften zu Marburg, Band IX and Band X, parts 1, 2, 3 and 4; also Sitzungsberichte, 1869–71. Nachrichten von der k. Gesellschaft der Wissenschaften und der George-August Universität, Göttingen, 1872. Annales de la Société Entomologique de Belgique, Tome quinzième, Brussels, 1871–72. Annalen der Sternwarte in Leiden, 4to., third volume, Haag, 1872. Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, 1872; also Jaarbock of same for 1871, and Processen verbaal, 1871–72, Amsterdam.

Jahresbericht der Naturforschenden Gesellschaft in Emden, 1871. Kleine Schriften der Naturforschenden Gesellschaft zu Emden, XVI, 1872. Verhandlungen der Schweizerischen Nat.-Gesellschaft in Frauenfeld, August, 1871. (54 Jahresversammlung.) Abhandlungen des Nat. Vereins zu Bremen; Beilage No. 2, Bremen, 1872. Overland Monthly, August, 1873; from J. H. Carmany & Co.

Donations to Museum: Crustaceans (Humpback whale-food) from lat. 24° 27′ N., long. 111° 58′ W. Also, specimens of *Velella* and of *Lepadidæ*, collected in lat. 29° 52′, N. long. 116° 15′ W.; presented by Capt. William Metzgar. Fossil Shells, from an elevation of 800 feet on Cerros Island, Lower California, presented by Lieut.-Com. C. W. Kennedy, of the U. S. C. S. steamer *Hassler*. Two specimens of Ancient Pottery and Twine, from Inca graves, Peru, presented by C. A. Wetmore. Samples of Paper made of the wood of the American Poplar, from Alexander Austin. Specimen of *Cuproscheelite*, from the Green Monster Mine, Kern County, Cal., presented by Henry G. Hanks.

The President read the following, being an additional gift from James Lick:

THIS INDENTURE, made this eleventh day of July, in the year of our Lord one thousand eight hundred and seventy-three (1873), by and between JAMES LICK, of the city of San Jose, in the county of Santa Clara, in the State of California, the party of the first part, and the CALIFORNIA ACADEMY OF SCIENCES, a corporation organized and existing under and by virtue of the laws of the State of California, and having its principal place of business in the City and County of San Francisco, in said State, the party of the second part, WITNESSETH: that the said party of the first part, in consideration of the desire he has to promote the diffusion of science, and the prosperity and perpetuity of the said party of the second part, hath given, granted and confirmed, and by these presents doth give, grant and confirm unto the said party of the second part and its successors, all that certain parcel of land situate in said City and County of San Francisco, in the State of California, and bounded and described as follows, to wit:

Beginning at a point on the southeasterly line of Market street, distant one hundred and fifty-five (155) feet southwesterly from the southerly corner of Market and Fourth streets, and running thence southeasterly and parallel with said Fourth street one hundred and fifty-five (155) feet; thence at an angle of forty-five degrees (45°) southerly fifty-six and fifty-six one hundredths (56 56-100) feet, more or less, to a point which is one hundred and ninety-five (195) feet distant from the southwesterly line of said Fourth street, and one hundred and ninety-five (195) feet distant from the southeasterly line of said Market street;

thence northwesterly and parallel with said Fourth street one hundred and ninety-five (195) feet to the southeasterly line of Market street; and thence northeasterly along said last-mentioned line forty (40) feet to the point of beginning; being a portion of the lot known and designated on the official map of said City and County of San Francisco as "Hundred-vara lot number one hundred and twenty-six (126);" reserving and excepting out of and from said granted premises, all buildings, tenements and improvements of any of the tenants of said party of the first part that now are, or may be, situate thereon at the time when said party of the second part shall be entitled to the possession of said premises; and excepting and reserving out of and from this grant and conveyance the right to possess, use and occupy said premises for the period of two (2) years from the date hereof, unless sooner determined, as hereinafter provided; which right of possession, as aforesaid, said party of the first part hereby reserves unto himself, his heirs and assigns:

To HAVE AND TO HOLD, all and singular, the premises hereby given and granted unto said party of the second part and its successors, upon the following terms and conditions, nevertheless; which terms and conditions shall be binding and obligatory upon said party of the second part and its successors, that is to say:

First—That said premises shall be used and devoted solely and exclusively for scientific purposes and for none other, and shall never be used for political or religious purposes.

Second—That said premises shall never be incumbered by said party of the second part, or its successors; and shall never be allowed or suffered by said party of the second part, or its successors, to be sold for any taxes, assessments, or other charges levied or placed, or suffered to be levied or placed thereon.

Third—That said premises shall never be alienated by said party of the second part during the life of any of the existing members of said California Academy of Sciences.

Fourth—That said party of the second part shall never lease said premises or any part thereof, or any edifice or any part of any edifice erected or to be erected thereon; and said party of the second part shall never permit or suffer any person to possess, use or occupy the whole or any part of said premises, or any edifice or any part of any edifice, erected or to be erected thereon, save for its own proper purposes.

Fifth—That the building required to be erected by the conditions of the former deed of conveyance made by the said party of the first part to the said party of the second part, of a piece of land adjoining the aforesaid granted premises (which deed is dated the fifteenth day of February, A. D. one thousand eight hundred and seventy-three, and is recorded in the County Recorder's office of said San Francisco) shall, when erected, be made large enough to cover, and shall cover, all of the land hereby granted, besides covering the land by said former deed required to be covered by a building; and such building shall be forever maintained on both said parcels of land by the said party of the second part, and shall be of the following description, that is to say: A

substantial and elegant brick edifice, three (3) stories in height, with a substantial granite front, faced with appropriate scientific emblems. The structure and design of the edifice shall be classic, and such as will readily distinguish it from buildings used for business or commercial purposes. The style of architecture of said edifice shall be chaste and appropriate, and the same style and order of architecture shall be preserved throughout in its purity.

Sixth—In order to render this gift and conveyance effectual, said party of the second part must, within two (2) years from the date hereof, secure the necessary funds to commence and to complete said edifice; and must commence the erection of this edifice and complete the same with all reasonable dispatch; and as soon as said party of the second part shall secure the necessary amount of funds, at any time within said period of two (2) years, upon thirty (30) days' written notice of that fact to said party of the first part, or his heirs or devisees, the said party of the second part shall be entitled to the possession of said premises, and the right of possession of said premises hereby reserved to said party of the first part shall thereupon cease and determine. The said party of the first part hereby reserves to himself and his heirs and assigns the right to use and possess, and occupy said premises, until said party of the second part shall have secured the aforesaid necessary amount of funds, and until notified of that fact as aforesaid; but said funds must be secured, and the erection of said edifice be commenced, within a period of time not exceeding two (2) years, as aforesaid. At least one (1) apartment of said edifice shall be constructed suitably for, and devoted to, the purposes of a library; another apartment thereof shall be constructed suitably for, and devoted to, the purposes of a museum; and a third apartment thereof shall be suitably constructed for, and devoted to, the purposes of a hall for lectures.

Should said party of the second part, or its successors, violate or fail to fulfill any of the foregoing terms or conditions, then and immediately thereupon the estate and all interest hereby given and conveyed shall cease and determine, and the same, to wit: All interest and estate hereby given and conveyed shall immediately revert to and revest in said party of the first part, his heirs and assigns, without any previous entry to assert such failure or breach.

In Witness Whereof, the said party of the first part hereunto sets his hand and seal the day and year first herein above written.

[Signed] JAMES LICK. [L. S.]

Signed, sealed and delivered in the presence of:

Sam'l Hermann,
D. J. Staples,
John O. Earl.

STATE OF CALIFORNIA,
CITY AND COUNTY OF SAN FRANCISCO, } ss.

On this eleventh day of July, A. D. 1873, before me, Samuel Hermann, a Notary Public in and for the said city and county, duly commissioned and sworn, personally appeared James Lick, known to me to be the person whose name is subscribed to the within and foregoing instrument, and he, the said James Lick, duly acknowledged to me that he executed the same.

In witness whereof, I have hereunto set my hand and affixed my official seal the day and year in this certificate first above written.

[L. S.] [Signed] SAM'L HERMANN,
Notary Public.

Recorded in the office of the County Recorder of the City and County of San Francisco, July 26th, A. D. 1873, at 12 M., in Liber 712 of deeds, page 233.

[Signed] A. R. HYNES,
County Recorder.

After reading the deed, Prof. Davidson recalled the terms of the previous deed of February, in which the Academy was obligated to raise funds sufficient to complete the building, and commence its erection within two years; and in case of subsequent non-fulfilment of any of the conditions imposed upon us, the property was to revert and revest in James Lick and his heirs and assigns. The members had thought it possible to raise the money if the conditions were lightened; and he had conferred with Mr. Lick upon the subject, with a reasonable prospect of effecting a modification of the conditions.

This new deed continued and enforced the same obligations; and, from the increased size of the building, and the eastern side being intended to face a block comparatively open, the cost of erection would not be less than $300,000, whilst the taxes and assessments would amount to at least $5,000 per annum. These and other objections to the project were fully stated as insuperable; yet, notwithstanding this fact, Prof. Davidson urged the Academy to accept the new deed, and await the result of future conferences with Mr. Lick, who was really anxious to benefit the Academy. It was no burden to them, as the taxes and assessments were paid by the donor. He would call a special meeting of the Trustees at once,

and embody the objections to the conditions of the deeds in a practical shape for discussion by the Trustees, that they might submit their views to Mr. Lick.

It was moved by Dr. George Hewston, that the Trustees be authorized to receive the additional donation of Mr. James Lick, and return the thanks of the Academy. After some discussion, the motion was seconded and unanimously carried.

Mr. Stearns submitted the following papers:

Shells collected at San Juanico, Lower California, by William M. Gabb.

BY ROBERT E. C. STEARNS.

The species contained in this and the succeeding list, were collected in the month of February, 1867, by Prof. Gabb, who kindly submitted the same to me for examination. As the knowledge of Lower California Mollusca is exceedingly limited, the publication of these lists may be of some benefit to students, and of value as data bearing upon geographical distribution. San Juanico is on the east side of the peninsula of Lower California, in latitude about 27° north.

Solecurtus Californianus, *Conr.*
Periploma argentaria, *Conr.*
Standella planulata, *Conr.*
Amphichæna Kindermanni, *Phil.*
Peronæoderma viriditincta, *Cpr.*
Donax flexuosus, *Gld.*
Semele bicolor, *C. B. Ad.*
Fulvia aspersum, *Sby.**
Cyclas dentata, *Wood.*
Mysia orbella, *Gld.*
Crassatella gibbosa, *Sby.*
Lazaria radiata, *Brod.*
Arca Pacifica, *Sby.*
Anomalocardia grandis, *Brod. & Sby.*
" multicostata, *Sby.*
" tuberculosa, *Sby.*
Vola dentata, *Sby.*
Chione fluctifraga, *Sby.*
Chione succincta, *Val.*
Chione simillima, *Sby.*
Callista chionæa, *Mke.*
Tivela radiata, *Sby.*
Dosinia ponderosa, *Gray.*
Cardium senticosum, *Sby.*
Omphalius fuscescens, *Phil.*
Crucibulum imbricatum, *Sby.*
Haustator goniostoma, *Val.*
" tigrina, *Kien.*
Cerithidea albonodosum, *Cpr.*
Trivia radians, *Lam.*
Strombus granulatus, *Swains.*
Neverita Recluziana, *Rve.*
Malea ringens, *Sby.*

*In Adams's Gen. Moll. this species is catalogued as "aspera, *Sby.*;" but in Sowerby's Conch. Illustr. (Fig. 15) it is "C. aspersum, *Sow.*, Zool. Proc. 1833, p. 85," and is credited to "St. Elena, Mr. Cuming." It is strikingly like its Caribbean analogue *F. bullatum*. St. Elena is on the coast of Guayaquil, in latitude about 2 deg. south. If Mr. Cuming's "habitat" is correct, it shows a wide range, and the two species mentioned herein may have descended from the same ancestors.

Chiton (Lepidoradsia) Magdalensis, *Hinds.*
Fissurella volcano, *Rve.*
Callopoma tessellatum, *Kien.*
Lagena nodosum, *Chemn.*
Tritonidea insignis, *Rve.*
Cassidulus patula, *Brod.* and *Sby.*
Harpa crenata, *Swains.*
Oliva venulata, *Lam.*
Macron Æthiops, *Rve.**
Fusus Dupetithouarsii, *Kien*
Phyllonotus bicolor, *Val.*
Murex plicatus, *Sby.*

Shells collected at Loreto,† Lower California, by W M. Gabb, in February, 1867.

BY ROBERT E. C. STEARNS.

Cyathodonta undulata, *Conr.*
Semele bicolor, *C. B. Ad.*
Chione succincta, *Val.*
Callista chionæa, *Mke.*
Tapes (Cuneus) grata, *Say.*
Cyclas dentata, *Wood.*
Pecten subnodosus, *Sby.*
Bulla Adamsi, *Mke.*
Acmæa fascicularis, *Mke.*
Crucibulum spinosum, *Sby.*
Neritina picta, *Sby.*
Luponia Sowerbyi, *Kien.*
Trivia Solandri, *Gray.*
Surcula funiculata, *Val.*
Architectonica granulata, *Lam.*
Pyrazus incisus (dwarf variety).
Natica Pritchardi, *Fbs.*
Mamma uber, *Val.*
Neverita Recluziana, *Rve.*
Oliva (Ispidula) venulata, *Lam.*
Olivella dama, *Mawe.*
" intorta, *Cpr.*
Purpura (Stramonita) biserialis, *Blainv.*
" " triangularis, "
Sistrum carbonarium, *Rve.*
Engina crocostoma, *Rve.*
Columbella fuscata, *Sby.*
Conella cedo-nulli, *Rve.*
Nassa tegula *Rve.*
" versicolor, *C. B. Ad.*
Anachis lyrata, *Sby.*
" nigricans, *Sby.*
" serrata, *Cpr.*
Strombina maculosa, *Sby.*
Murex plicatus, *Sby.*

**Macron* (a subgenus of *Pseudoliva* made by the Adams's), includes three species all peculiar to the west coast of North America, and inhabiting a semi-tropical and littoral station from (and including) San Diego in California proper, thence southerly, and both coasts of Lower California; also at "Cedras" or Cerros and other islands along the outer coast of the peninsula; all of the species are covered with a thick, black epidermis; *M. Æthiops*, the largest, is traversed spirally by broad, moderately deep grooves from apex to base; while *M. Kellettii*, A. Ad., has generally only three below the middle of the body whorl, otherwise being nearly smooth. The most northern and smallest of this group is *M. lividus*, A. Ad., which seldom attains the length of an inch, the average of many measurements being .77 inch; this latter species is proportionately less inflated than either of the others, and is not uncommon at San Diego; the other species are comparatively rare.

†Loreto is in latitude twenty-five degrees fifty-nine minutes N.; longitude 113 degrees twenty-one minutes W.; Lower California.

Notes on Cuproscheelite.

BY HENRY G. HANKS.

Several months ago, Mr. J. B. Treadwell handed me a mineral for examination which he found at the Green Monster Mine, Kern County, twelve miles east of White River Postoffice, a specimen of which I present this evening. At the first glance I supposed it to be *Sulphate of Baryta*, colored by an admixture of some foreign substance; but to my surprise I found it to contain no trace of baryta. I then submitted the mineral to a physical and chemical examination, of which the following is the result: The mineral is *massive and homogeneous; color*, yellowish-green; *lustre*, vitreous; *hardness*, 5.5; *streak*, white; *specific gravity*, 5.863+; *anhydrous; fusible*, after heating turns purple; *not magnetic*; B. B. dissolves in borax to an opaque white bead; B. B. dissolves in microcosmic salt, color, green, hot and cold; gives a reaction of *copper;* not soluble in *water, hydrochloric acid*, or *aqua regia*, even after fusion with *bi-sulphate of potash*; a dense, golden-yellow powder remains in every case; *in a closed tube* no sublimate, *absence of sulphur*; does not blacken; *absence of carbon*; *heated with cyanide of potassium and water*, gives no reaction of silver in the filtrate, while white residue treated with sulphide of ammonium does not blacken, *absence of lead*. The powdered mineral found by the above treatment to be free from *sulphur*, *carbon*, *silver*, and *lead*, was fused with the following flux: 1 part *nitrate of potash*, 2 parts carbonate of potash, 2 parts carbonate of soda, by which means it was brought into solution, the residue, undissolved by water, being wholly soluble in hydrochloric acid. Although this mineral strongly resembles scheelite, yet the presence of copper and its inferior specific gravity separate it from that species. I then made a microscopical examination of the mineral to ascertain if the copper might be a mechanical mixture, but found it perfectly homogeneous.

Believing it to be new, I set it aside for a careful analysis at my leisure. Not long since I showed the specimen to Prof. Whitney, who recognized it as *Cuproscheelite*, described by him in Vol. 3 of this Society's proceedings, page 287.

Although not new, it is still interesting to science as coming from a new locality, and being found in abundance.

As a source of tungstic acid it will be valuable to the arts, as according to the analysis of Prof. Whitney it contains 79.69 per cent. of that rare acid, and is easily decomposed.

With this I present a sample of Tungstic acid, obtained by simply boiling the mineral in hydrochloric acid.

Scheelite has been observed in the Mammoth District, Nevada, and *Cuproscheelite* in several mines in Lower California, but I am not aware that there is any other known locality in which Tungstate of Lime in either form is found in any considerable quantity.

According to Prof. Whitney, Cuproscheelite has the following composition:

Tungstic acid	79.69
Oxide of copper	6.77
Lime	10.95
Protoxide of iron	.31
Water	1.40
	99.12 per cent.

Mr. S. C. Hastings read a paper on Climatic Changes.

Mr. Wetmore submitted, for the inspection of the members, several skulls taken from ancient graves in the upper table-lands of the western slope of the Andes, in Peru. These skulls presented some marked cranial differences, indicating different races. Some of these presented the peculiarities of the Inca type, while others point more to that of the aboriginal Indian, and show a marked flattening of the frontal section, which, in one specimen, is traversed by a median suture from above the nasal orifice backward, dividing the frontal bone equally.

Mr. Stearns announced to the Academy the death of Col. John W. Foster, the distinguished geologist and ethnologist, and President of the Academy of Sciences of Chicago.

On motion of Dr. George Hewston, Mr. Stearns was appointed a committee to prepare resolutions appropriate to the event.

On an Improved Telemeter for Reconnaissance, Engineering, and Military Purposes.

BY GEORGE DAVIDSON.

The fundamental idea of this telemeter is credited to General Clerk, R. A., F. R. S., etc., who designed it for military purposes, and had one, of two feet in length, made by Pastorelli & Co., of London, (*Engineering* for November 15, 1872, p. 333, vol. II), with a mirror at each end and two in the center. With the micrometer eye-piece he "obtained great accuracy up to 600 feet distance," and the results were "tolerably certain up to 3,000 feet." A similar instrument of six feet in length gave good results at three thousand yards.

The improvement which we have made, in addition to some matters of detail, is what may be called a repeating micrometer, with a screw of much finer thread than used in the above instruments, where one micrometer division was eleven seconds of arc. In the micrometers of the Coast Survey Field Transits, Zenith Telescopes and Theodolites, the micrometer divisions range in value from

four-tenths of a second of arc to six-tenths, and are read to one-tenth of a division, or six-hundredths of a second of arc. For work with this instrument the micrometer may be divided to seconds of arc, and read to half seconds or less.

Figure 1 exhibits, without details of bars or adjustment, a plan of the tube *A B*, carrying the base bar of six feet, the object glasses *O* and *O'* of two telescopes with micrometer eye-piece *E*, common to both, and the prisms *L*, *R*, and *C*, *D*. This tube will be about three inches in diameter; the object glass about two and a half inches, and the powers of the eye glass from twenty to fifty. An opening can be made in the center of the tube in front of the prisms for illumination at night; and above the eye tube a short outside director to rapidly obtain the direction of the object to be observed upon.

Instead of reflectors, right-angled prisms are prepared and arranged for each telescope, with their hypothenusal sides parallel to each other at an angle of forty-five degrees with the base. Necessarily the central prisms, *C* and *D*, are placed one above the other, but touching. With this arrangement a ray of light from an infinite distance, or from a star, after entering the object glass, *O*, follows the direction of the line, a, a, a', in the left-hand telescope to the point, *X*, in the focus of the telescope, and also entering *O'*, follows the line, b, b, c', in the right-hand telescope to the same point. If the prisms are in adjustment, the image of a star through each telescope will be seen as a single object at *X*. And this last condition is the test of adjustment. In using a star the adjustment would necessarily be made at night, but the test could be frequently made during the day by similar observations upon the border of the sun, or upon some well marked spot on its disc. If it is desired to test the adjustment upon a near object, say at one hundred yards, then after the adjustment upon a star or the sun, the micrometer difference of the two images of an object at that distance must be determined (or may be computed) and used thereafter as a constant from which to make the necessary adjustment for infinite distance. But this method would require the change of focus of the telescope, whence would arise change of the arc value of the micrometer divisions.

If the prisms are in adjustment and the object observed upon is not at an infinite distance, the rays of light from it will not enter the two object glasses in parallel lines, but at angles varying with a function of the distance, and will follow the lines, $c\, c\, c'$ and $d\, d\, d'$, so that the images, *P* and P', of the same object will be formed at the common focus of the two telescopes. The horizontal distance apart of these images is measured by the micrometer, and the distance of the object deduced therefrom.

With the ordinary micrometer this separation of the images can be measured by single readings only, but with the proposed micrometer the measure may be repeated any number of times, thereby virtually increasing the length of base used, by each repetition. Thus, by repeating the measure ten times, we have, as it were, increased the case from six to sixty feet; whilst a second set of ten repetitions serve not only as a test of the first set, but give an accuracy approximating that obtainable with a base of one hundred and twenty feet.

Figure II exhibits the repeating micrometer, which essentially consists of three frames. The first, *F*, is attached by screws to the eye tube of the telescope. At the left-hand end it carries a moderately fine micrometer screw, *G*, which moves the two frames, *H* and *I*, which are themselves attached to each other by the fine micrometer screw, *J*, bearing the micrometer head, *K*, and carrying the micrometer thread, *N*. The springs, *S* and *S'*, between *F* and *H*, are for keeping a constant strain between the two frames; and the springs, *L* and *L'*, between *H* and *I*, are for a similar purpose. The frame, *H*, carries the micrometer rack, *M*, by which the whole turns or revolutions of the micrometer head of *J* are noted.

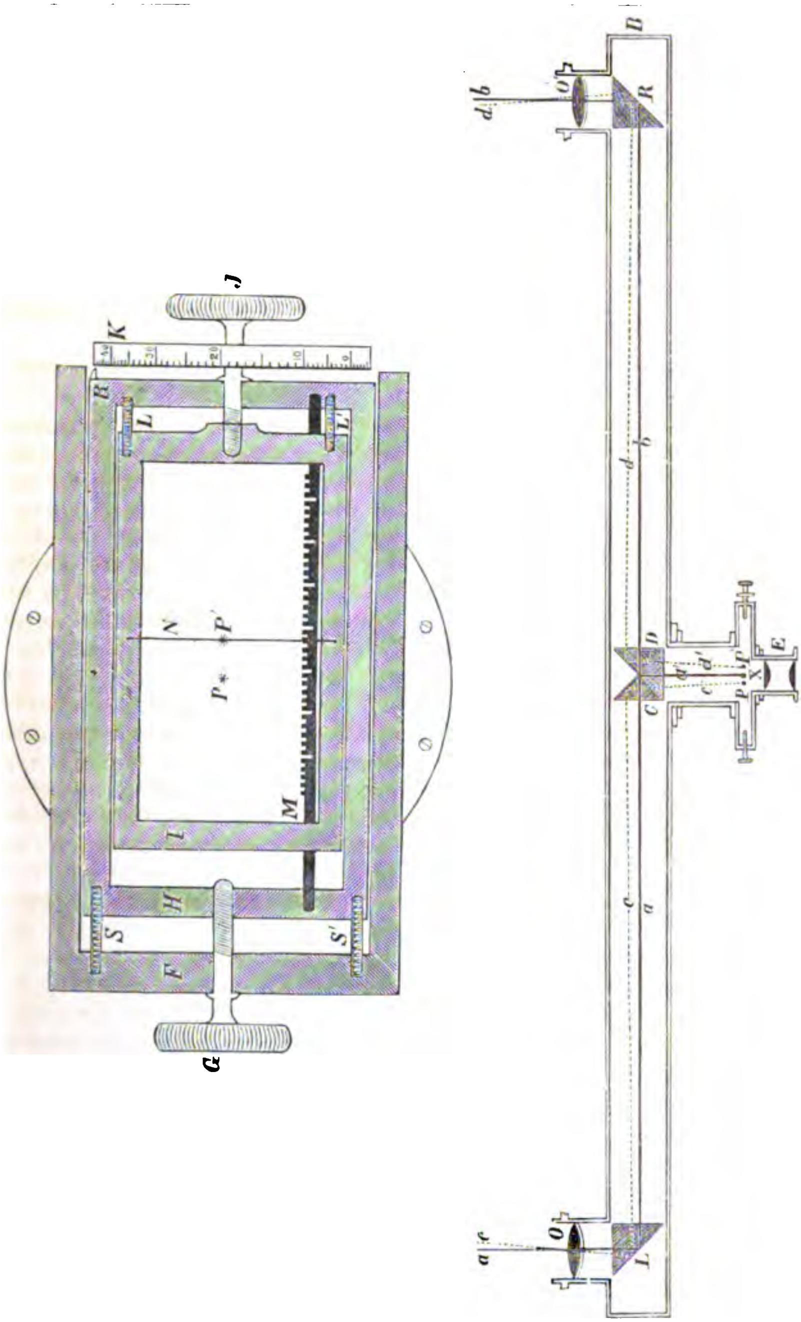
The action of the micrometer is therefore readily seen, and the operation of observing is as follows:

P and *P'* (in both figures) are the two images of the object to be observed upon. The micrometer *J* may be turned until the zero of the head is opposite the pointer *R*, then the micrometer *G* is turned (moving frames *H* and *I*) until the thread *N* bisects the left-hand image *P*; the micrometer *J* is then turned, moving the rack *I* only, until the thread *N* bisects the right-hand object *P'*, and the micrometer read off for the divisions less than one hundred, whilst the whole turns are noted on the rack, which has a notch for each turn of the micrometer; this difference of the two readings gives the distance apart of the two images of the object in terms of the micrometer, and constitutes one measure. The micrometer *G* is now turned, and carries both frames *H* and *I* until the thread *N* is brought back to bisect the image *P*; then the micrometer *J* is turned until the thread *N* bisects *P'*, and read off, as before, for a second measurement; and so for subsequent measures. The measures can be read off after each repetition; or, in rapid work, only the readings of the first bisection and the last in a set, and the micrometer divisions passed over, divided by the number of repetitions. And any number of sets may be made to test or increase the accuracy of the work.

If the images of the object to be observed upon are small, clear, and sharply defined, the probable error of the individual micrometer measures should not exceed half a second of arc, but, on account of the lack of definiteness and sharpness of most terrestrial objects, this probable error will be larger; nevertheless, it is perhaps a large allowance to assume that a probable error of one second of arc may exist in the mean of ten repetitions. At the distance of one mile this would involve an error of little more than two feet; and at five miles, of only fifty-five feet.

Of course, another function of the accuracy of the distance is the accuracy of the base-bar itself in the instrument; but this can be obtained with great precision. And as the base changes its length by changes of temperature, tables of distances for a series of micrometer differences, with the base-bar at different temperatures, can be readily constructed.

Upon the upper and middle part of the bar-tube a small prismatic compass was placed by General Clerk, to obtain the magnetic bearing of the object. In



IMPROVED TELEMETER. DAVIDSON.

[SEE PAGE 135]

addition to this we propose to place a small vertical arc and attached level, to give the angle of inclination; by which, with the distance, the difference of height between the object and observer may be obtained.

Regular Meeting, August 4th, 1873.

Prof. J. D. Whitney in the Chair.

Thirty-two members present.

David J. Staples, Solomon Goldsmith, Alfred Wheeler, Albert Williams, Jr., and R. D. Plummer, M.D., were elected resident members.

Donations to Library: Proceedings of Royal Geographical Society, Vol. XVII, No. II. Proc. Boston Nat. Hist. Society, Vol. XV, Part II. Memoirs of Boston Nat. Hist. Society, Vol. II. Catalogue of the Museum of the Chicago Medical College. Transactions of the Academy of Science of St. Louis, Vol. III, No. I, 1873. Proc. Acad. Nat. Sciences, Phila., pp. 249–280, 1873. Sixth Annual Report of the Peabody Institute of Baltimore, 1873. California Horticulturist, July, 1873, from Publishers. American Journal of Science and Arts, July, 1873. American Naturalist, July, 1873. American Chemist, June, July, 1873. Climats, Geologie, Faune et Geographie, Botanique du Brésil, par Emmanuel Liais, 8vo., Paris, 1872, from the Brazilian Legation to the United States. Engineering and Mining Journal (5 papers) for July, 1873. Mittheilungen der Deutschen Gesellschaft fur Natur und Völkerkunde, Ost-Asien's, Yokohama, Mai, 1873. Report of the Geological Survey of New Hampshire for 1872, from C. H. Hitchcock, Ph. D. Monatsbericht der Könighlich Preuss, Akad. der Wissenchaften zu Berlin, Feb., 1873. Yale College in 1873, Pamph., 8vo. Catalogue Library Company of Philadelphia, July, 1873. Publications of the Geological Survey of the State of California, as follows: Mining Statistics, No. 1, 1866; Geographical Catalogue of the Mollusca, 1867; Catalogue of the Invertebrate Fossils of the Western Slope of the United States, Part II, 1871; The Yosemite Guide Book, 1870; The Yosemite Guide Book (Pocket Ed.), 1871. Palæontology, Vol. I, 1864; Vol. II, 1869. Geology, Vol. I, 1865. Ornithology, Vol. I, 1870. Map of the region adjacent to the Bay of San Francisco, 1873. Topographical Map of Central California, etc., 1873: all of the above presented by the State.

Additions to Library by Purchase: Journal of Botany for July, 1873. Annals and Magazine of Natural History, July, 1873, Popular Science Monthly, August, 1873. Nature, June 5th, 26th, July 3d, 10th, 1873. Annalen der Physik und Chemie, No. 4, Leipzig, 1873. Quarterly Journal of Microscopical Sciences, London, July, 1873.

Donations to Museum: Nest and eggs of Marsh Wren (*Troglodytes palustris*, Aud.), found in the tules of the San Joaquin River, presented by C. D. Gibbes. Specimens of *Chimæra Collei*, male and female, from J. P. Dameron. Specimen of a species of *Pennatula* (probably *P. tenua*, Gabb); also, a specimen of a *Virgularia* from the Gulf of Georgia, presented by Dr. James Blake.

Mr. Gibbes said that the nest and eggs presented by him this evening were those of the Marsh Wren (*Troglodytes palustris*, Aud., Vol. II, p. 135, pl. 123). These nests are abundant throughout the swamp lands; are purse-shaped, about seven inches in length, by four and five inches in diameter, composed of flexible grasses ingeniously woven together, suspended three or four feet from the ground, attached to the upright tules by being woven around them, a small entrance is left near the top, and is lined with soft grasses and down, from the plant known as the "cat-tail."

This nest was found in April, in the tules of the San Joaquin River, and had but three eggs in it; but I suppose they lay more, as the brown-headed Wren has six. These eggs are of a light brown mahogany color, with darker dashes, varying in intensity of shade. Although I have seen many nests, this is the only one in which I have discovered eggs. I hope in another year the Society will have a good collection of the eggs of the California birds, particularly of such nests as display ingenuity in construction.

Dr. Blake presented to the Academy a specimen of a *Pennatula*, which had been taken by Captain Dane about one mile S.E. of Cape Roberte, in the Gulf of Georgia, in about seven fathoms water. Captain Dane states that "they were kept some days in a large tub of water, the water being changed frequently. They stretched out to about thirty inches in length, the fringed part forming about half the length and being five inches in diameter, the smooth part three inches. They seemed to have no powers of locomotion, but were entirely at the mercy of the currents." The external form of this specimen differs from the ordinary *Pennatula* in having four rows of *pinnæ*, two of which are much more developed and support the polyps, whilst the other two rows are very much smaller, and apparently are free from polyps. In its present

contracted state the animal measures about ten inches long, one and seven-tenths inches across in one direction, and one and one-tenth inches the other. The free edge of the larger polyp-bearing *pinnæ* measured two and a half inches; that of the smaller *pinnæ*, six-tenths of an inch. The cavities with which these different sets of *pinnæ* communicate are apparently totally distinct, being separated by a mesentery which is attached to an axis running the whole length of the body. This axis is firmly calcified in its middle portion, the two ends being formed of a softer, chitonous substance. This axis, except as regards its length, is apparently the counterpart of the long twigs that were received some months since from Burrard's Inlet. As regards the functions of the smaller sets of *pinnæ*, I think they are connected with the water supply to the somatic cavities, as they contain numerous tubes. Should this be the case, a connection must exist between the cavities on each side of the mesentery. These *pinnæ* are thickly studded with calcareous *spiculæ*.

Mr. Stearns said that the larger of the specimens presented by Dr. Blake was undoubtedly a *Virgularia*.

Dr. Cooper suggested that it might be the adult of the species described by Mr. Gabb in the Academy's proceedings, some years ago.

Mr. Goodyear read the following paper:

On the Situation and Altitude of Mount Whitney.*

BY W. A. GOODYEAR,* C. E.

On the 27th day of July, 1873, Mr. M. W. Belshaw, of Cerro Gordo, and myself, rode our mules to the highest crest of the peak southwest of Lone Pine, which, for over three years now, has been known by the name of Mount Whitney, and which was ascended and measured as such by Mr. Clarence King, in the summer of 1871. A full account of Mr. King's ascent of this peak is given in his "*Mountaineering in the Sierra Nevada*," pp. 264–281.

I know this peak well, and cannot be mistaken as to its identity. As seen from Lone Pine, it appears perhaps the most prominent peak in the whole Sierra; and during the summer of 1870, when, in company with Mr. C. F. Hoffmann and Mr. Alfred Craven, I made a trip for the State Geological Survey through Owen's Valley and the Inyo Mountains, this peak was the object of constant observations by us for a month or more, under the name of Mount Whitney, —which we then supposed it to be. Moreover, since Mr. King's ascent of it in

*Published in advance, August 6th, 1873.

1871, the half dollar which he left at the summit has been found there, with his name inscribed upon it. There can, therefore, be no mistake as to the identity of this peak with the one ascended and measured by Mr. King in 1871.

I do not mention the fact that Mr. Belshaw and myself reached its summit in the saddle as being one of any new or special interest; for Mr. Sheriff Mulkey, of Inyo County, accomplished the same thing on the 6th day of August, 1872, with his family (*i.e.*, his wife and daughter), and since that time it has also been done by several other parties.

But there is some interest in the fact discovered by Mr. Belshaw and myself, when we reached its summit—that *this peak is not Mount Whitney.*

It is by no means the highest among the grand cluster of peaks which form this culminating portion of the Sierra Nevada; *nor is it the peak which was discovered by Prof. W. H. Brewer and party, in* 1864, *and then originally named by them Mount Whitney.*

For the truth of such a statement as this, after the mountain has become so famous, I shall of course be expected to produce my evidence.

How, then, in the first place, do I know that this so-called Mount Whitney is *not the highest peak* in this vicinity?

First, because on reaching its crest, the fact is at once not only apparent, but very striking, even to the unaided eye alone, that a peak which bears N. 67° W. magnetic, distant between five and six miles from the observer, is considerably higher than the one on which he stands.

To this it will, perhaps, be objected that it is extremely difficult to judge accurately of relative heights with the eye alone; and that, in so judging, the best observers are liable to be deceived. But while, of course, admitting the truth of this statement, as a general fact and within certain limits, I still reply that no *good* eye is ever deceived as to which is the higher of two culminating peaks among such a mass of mountains, when the observer is standing on the lower peak, with a perfectly clear atmosphere between, and nothing to obstruct the vision—the distance between the peaks not exceeding half a dozen miles, and the actual difference of altitude between them being anywhere in the vicinity of a hundred feet to each mile of the distance.

My second proof of the relative altitude of these two peaks is the following:

I had no spirit-level with me; but I did have this miner's compass, 3¼ inches square, with a clinometer attached. On setting the index of the clinometer at zero, and then sighting along the upper edge of the plate, the line of sight struck far below the summit of the other peak. Then, on reversing the instrument end for end, setting the clinometer again at zero, and sighting along the upper edge of the plate as before, the line of sight, though it struck a little higher than before (thus showing a slight error in the instrument), nevertheless still struck far below the peak. This, if the sighting along the edge of the plate was correctly done, is proof positive that the distant peak is the higher.

But we applied still a third test. While I was busy with my notes, Mr. Belshaw improvised a still more perfect level, by taking a pint cup, four inches in diameter, and filling it *heaping full* of water—*i. e.*, so that the water stood

higher then the edge of the cup all around the rim, yet without overflowing When this was done, it became at once evident, on sighting across the smooth surface of the water, that the other peak was higher than the one on which we stood by an amount which we both of us estimated to be *not less than* 500 *or* 600 *feet*.

As to the proofs that the peak which we climbed *is not the one originally named Mount Whitney by Professor Brewer's party, in* 1864, they are numerous; and among them are the following:

In the first place, Mr. Clarence King, in 1864, on reaching the summit of Mount Tyndall, remarks as follows, in the *Geological Survey Report* (Geology, vol. I, p. 386):

"On setting the level, it was seen at once that there were two peaks equally high in sight, and two still more elevated—all within a distance of seven miles. Of the two highest, one rose close by, hardly a mile away; it is an inaccessible bunch of needles, and we gave it the name of Mount Williamson. The other, which we called Mount Whitney, appeared equally inaccessible from any point on the north or west side; it is between seven and eight miles distant, in a south-southeast direction, and, I should think, fully 350 feet higher than our peak." (Further investigation showed that it was really 600 or 700 feet higher than Mount Tyndall.)

Now, the peak which we climbed is certainly not 350 feet higher than Mount Tyndall, but very nearly the same altitude. In fact, as closely as we could judge by our water-level at such a distance, Mount Tyndall appeared a *trifle* the higher of the two. Moreover, this peak, instead of being between seven and eight miles distant in a south-southeast direction from Mount Tyndall, is between twelve and thirteen miles distant from it, in a direction about S. 37° E. true course; while the genuine Mount Whitney (*i. e.*, the highest peak) is actually distant from Mount Tyndall only about seven and one quarter miles in a direction about S. 26° E. true course—thus corresponding exactly with this remark of King's in 1864. It is evident enough that this difference between seven or eight and twelve or thirteen miles of air-line distance involves an error which Mr. King would have been by no means likely to make in his estimate of the distance in 1864; while the direction S. 26° E. also corresponds far more nearly to Mr. King's words, "a south-southeast direction," than the course of S. 37° E. does.

Again, after Mr. King's ascent of Mount Tyndall, and the return of the party to Visalia, Mr. King made another excursion into the mountains, leaving Visalia July 14, 1864, for the purpose of making an attack on Mount Whitney. He followed from Visalia a trail which appears, so far as his description and my information give the means of identifying it, to have been the present Hockett Trail, to the point where it crosses the main Kern River. From this point Mr. King followed some route among the upper branches of the Kern River, which he has not described with sufficient clearness to enable it to be accurately traced on any map with which I am acquainted in the Geological Survey Office, or elsewhere, to the base of Mount Whitney. In his attempt to scale the summit of the mountain, he did not at that time succeed. But the highest point which he reached, as indicated by his barometric observation, was "ac-

cording to the most reliable calculations, 14,740 feet above the sea-level." And "at the point where this observation was taken, he was, as near as he was able to estimate, between 300 and 400 feet lower than the culminating point of the mountain, which, must, therefore, somewhat exceed 15,000 feet in height."

Now, although I do not recollect the exact figures which Mr. King's observations in 1871 gave for the height of the peak which he then measured as Mount Whitney, and to whose summit Mr. Belshaw and I rode the other day in the saddle, I do recollect, with certainty, the fact that these figures were a little less than the altitude of the point which he actually reached in 1864, when he was still, according to his own estimate, "between 300 and 400 feet lower than the culminating point" of Mount Whitney.

Here, then, there was a discrepancy of at least 300 or 400 feet, and probably somewhat more, between Mr. King's barometric results in 1864, and his results in 1871: a discrepancy hitherto utterly unaccounted for, and, if the two peaks were identical, unaccountable, except by supposing the existence of errors of a magnitude which is, to say the least, extremely improbable, in the whole method of computing high altitudes from barometric observations. This strange discrepancy vanishes at once, when the fact is recognized that in 1864, Mr. King was attempting a different and a higher peak than the one he climbed in 1871.

Moreover, the shape of the peak and the surrounding country fully justifies me in making the statement that neither Mr. King, nor any other good mountain climber, would ever have reached a point within three or four hundred feet of the summit of the peak which he measured in 1871, and then have given it up in despair. If he had approached this mountain from anywhere on the north or northwest sides, he could never have reached a point so near the summit; for the precipices in these directions are tremendous, for at least a thousand to fifteen hundred feet below the crest; and on the other hand, if he had approached it anywhere from W. S. W., around by south to southeast, he would have gone directly to the summit with no difficulty whatever; for in all these directions the slopes are comparatively smooth and easy.

The following remarks from the Geological Survey Report (Geology, vol. I, pp. 390 and 391), and for which Mr. King's notes of 1864 also furnished the material, will be sufficient additional proof, I think, of the fact, that the peak which for three or four years has borne that name, is not the one originally named Mount Whitney.

"Mount Whitney is a ridge having somewhat the outline of a helmet, the perpendicular face being turned toward the east. There is snow on its summit, which indicates that there must be a flat surface there. The mountain is the culminating point of an immense pile of granite, which is cut almost to the centre by numerous steep and almost vertical cañons, ending in high-walled amphitheatres. Southward of the main peak, there is a range of sharp needles, four of which are over 14,000 feet high. The general aspect of the group is much like that of Mount Tyndall. This mountain has been approached on all sides except from the east, and found to be utterly inaccessible. Mr. King

thinks it possible, however, that some route may yet be found by which the summit can be reached."

Now, this description corresponds in every respect, so far as Mr. Belshaw and I could see and judge, with the grand peak to the northwest of us — the original Mount Whitney; and it does not correspond at all with the one we were on, and which by mistake has borne the name so long.

Mount Whitney, having "its perpendicular face turned toward the east," looks from Lone Pine like a pretty sharp conical peak. The other peak shows the "helmet outline" from Lone Pine, and its perpendicular face is turned toward the north and northwest instead of the east; while the true Mount Whitney, as seen from the summit of this peak, assumes again the "helmet outline," with the steepest bluff to the eastward.

Again, the peak we climbed is not cut anywhere near to the centre by cañons, either numerous or steep, on the south or southwest sides. Furthermore, there is no vestige of a range of "sharp needles" to the south of it, or of anything that could suggest such an idea; while immediately to the south of the towering peak, northwest from the one we climbed, there is precisely such a range of tremendous and utterly inaccessible crags and turrets, and sharp and lofty pinnacles.

The mountain which we climbed also, instead of being inaccessible "on all sides except from the east," is, as already stated, very easily accessible from anywhere from W. S. W., around by south to southeast.

In the face of all these facts, though it may be possible, yet it certainly seems hardly credible, that Mr. King, familiar as he was, or at least ought to have been, long previous to 1871, with the general appearance of the whole region of country immediately to the north and northwest of Mount Whitney should, on reaching in 1871 the summit of the peak to whose crest Mr. Belshaw and I lately rode our mules, have failed to recognize at once the fact that he was on a lower and a different peak from the one he had attempted in 1864. And yet, on the other hand, if he did recognize this fact, then why, on his return from the trip which he made in the summer of 1871 for the special purpose of climbing and measuring Mount Whitney, did he not make it known and give it publicity?

In any case, the fullness of detail with which Mr. King, in "*Mountaineering in the Sierra Nevada*," (pp. 277 and 278)—while standing, in reality, on a peak over five miles distant from the one which he says was under his feet—appears to recognize all the topography of the scenes of his earlier struggles, and of his attempts to reach the summit of Mount Whitney, in 1864, is something interesting.

Certain it is, however, that the peak which for over three years has borne the name of Whitney, has done so only by mistake, and that a new name must be found for it; while the name of Whitney must now go back to the peak to which it was originally given in 1864, and which is, in reality, the highest and grandest of this culminating cluster of the Sierra Nevada.

Furthermore, it appears that Mount Whitney not only retains its claim to being the highest point of land in the United States of America, but that its

claim to over 15,000 feet of absolute altitude above the sea is still indisputable; while, up to the present time, it also retains the prestige of the fact that, in all probability, no human foot has ever trodden its summit.

If Mr. King's descriptions, in 1864, of the appearance and surroundings of this mountain on the north and northwest can be relied upon, it is safe to say that no man will ever ride a horse or mule to the summit of *that* peak, unless it be by a costly as well as a dangerous trail.

Whether the peak is utterly inaccessible or not, is still a question. I am disposed to think that it can be climbed; but it will certainly involve a great deal of hard, and very possibly, some dangerous work for anybody who shall attempt to reach its gigantic crest.*

Mr. Stearns, of committee, reported the following resolutions on the death of John W. Foster:

Resolved, That the California Academy of Sciences has learned with exceeding sorrow of the death of Dr. John W. Foster, late President of the Academy of Sciences of Chicago, and that we heartily sympathize with the members of said Academy in this latter affliction, as well as in the many other calamities which have recently befallen them.

Resolved, That in the death of Dr. John W. Foster, we recognize the loss of a man whose nobility of character, scientific labor and high attainments — exalted humanity, and endeared him to his fellow-men.

Resolved, That the California Academy of Sciences sincerely sympathizes with the family of the deceased.

Resolved, That a copy of these resolutions be forwarded to the family of the late Dr. Foster; also to the Academy of Sciences of Chicago.

Prof. Whitney read communications announcing the deaths of Professors Christopher Hansteen and Axelius Jonas Boeck, of Christiana.

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*NOTE.—Aug. 6: I have just received from Mr. Belshaw the results of a rough triangulation made by him from Cerro Gordo to the summits of the two peaks in question, since my return.

The figures given by this triangulation, though not to be relied upon as very accurate, are still sufficiently so to show clearly the relative situation of things, and to furnish additional confirmation of the facts as stated in the above paper.

He makes the air-line distance from Cerro Gordo to the peak measured by Mr. King, in 1871, in a course S. 72° W. magnetic, 25 miles, and the altitude of this peak 14,033 feet. The distance to the genuine Mount Whitney he makes 30.18 miles, in a direction S. 80° 5. W. magnetic, and its altitude 14,930 feet.

Both these altitudes are probably too low; but there can be no question as to which is the higher peak.

Regular Meeting, Monday, August 18th, 1873.

President in the Chair.

Twenty-six members present.

Charles Stephens, E. D. Farrington, Frederick Gutzkow, Lewis Locke, J. H. Locke, Charles L. Weller, and Edward W. Corbett were elected resident members, and Leland Stanford and Irving M. Scott, life members.

Donations to Library: Nature, Vols. I and II, from R. E. C. Stearns. D'Orbigny's Dictionnaire Universel d'Histoire Naturelle, text, 13 vols., atlas, 3 vols., hf. mor. (by purchase).

Donations to the Museum: Ferns, collected by Rev. J. Buchanan in Natal, South Africa, presented by H. N. Bolander. Specimen of Tunny? caught in San Francisco Bay, from S. R. Throckmorton. Specimens of *Pavonaria* (*Verrillia Blakei*, Stearns) from Burrard's Inlet, Gulf of Georgia, presented by J. S. Lawson, U. S. C. S.

The President remarked that the Academy had obtained the skin and skeleton of a Sea Elephant from the coast of Lower California, which made a valuable addition to our collection.

Mr. Stearns called the attention of the Academy to the handsome and appropriate black walnut case for the crystal models, which had been devised and presented to the Academy by their fellow-member Dr. A. B. Stout, who also had been to the trouble and expense of having the models repaired and whitened.

The President also called attention to several specimens of birds belonging to the Academy, which had been mounted by Mr. W. G. Blunt.

Professor Davidson read the following:

On the Auriferous Gravel Deposits of California.

BY GEORGE DAVIDSON.

At the regular stated meeting of February 3rd, our fellow-member Dr. Willey called attention to the auriferous gravel deposits of Placer County, to doubt

the sufficiency of water to disintegrate the quartz ledges containing the gold, and to round the quartz pebbles and boulders. He suggested volcanic agency, and the possibility of glacial action.

During this summer, I have visited some of the "hydraulic diggings," in counties to the south-east and to the north-west of Placer; and so far as I have examined them, I see in these great gravel deposits the results of one mode of production.

The "hydraulic" method of working is being pursued systematically and with increased intelligence, so that in a few years we shall be able to trace the bed-rock over areas sufficient to determine what was the power of disintegration and of subsequent movement.

My examinations were made incidentally in the course of more urgent duties, and were limited; but, so far as they went, I became satisfied that the chief power in disintegrating the materials and moving them was that of glaciers, aided in small amount by the water from the ice.

At Smartsville, there is a hill of auriferous gravel over 400 feet in height, lying between the hills of rock that have not "the color" of gold about them; these rocks are not of a character to retain for ages the marks of ice-action, and are moreover rarely exposed. The gravel about Smartsville is cemented together so compactly as to require the use of gunpowder to shake and shatter great masses sufficiently to be acted upon by hydraulic piping with a head of two hundred and fifty feet. Through the cemented mass are found fossilized oak trees of two and three feet diameter, and a close-grained tree, completely blackened, and reaching fifteen feet in diameter. Specimens of these I have brought for microscopic examination by our members.

So far as I could judge from its position and configuration, this hill formed a great glacial terminal moraine. I could not see how the action of water could produce it, or leave it where it was: the gravel, boulders, and cement do not bear the appearance of being formed by moving waters; and the gold particles, instead of being rounded, are flattened. Nor could I see how volcanic action could account for it; tufaceous lava may be part of the cementing material, but I could not appreciate it. Higher up this ancient bed, there are said to be no gravel deposits for fourteen miles; when they commence they are continuous for miles; but I had neither time nor opportunity to examine their relation to the adjacent hills.

At Cherokee Flat, Dr. Waldehr, superintendent of one of the gravel mines, assured me that in running a tunnel for their work upon the bed-rock, he has detected well-marked glacial markings.

There are doubtless many facts that can be aggregated to develop a theory to account for these deposits, which when gathered and fairly discussed may guide us aright. But we can only arrive at a safe and sound deduction by a study of the rock of the ancient bed when it shall have been exposed, and by an exhaustive orographical and geological survey of an extended line of these deposits and the adjacent country. And for this and similar ends, our State Government should be petitioned to grant more liberal appropriations to our State Geological Survey.

Description of a New Genus and Species of Alcyonoid Polyp.*

BY ROBERT E. C. STEARNS.

At a meeting of the California Academy of Sciences, held on the third day of February, 1873, a paper was read by me, entitled "Remarks on a New Alcyonoid Polyp, from Burrard's Inlet;" † in which I gave a *resumé* of the discussions, notices, etc., in this country and in England, arising from the examination by several naturalists, of certain "switch"-like forms, which had been received by different parties from the Gulf of Georgia (more particularly from Burrard's Inlet, in said gulf); several specimens of said "switches" being in the Museum of the California Academy.

These "switches," or rods, were referred by Dr. Gray, of the British Museum, to his genus "Osteocella," and by Mr. Sclater's correspondent stated to belong to "a sort of fish"; but by the majority of scientific gentlemen who had seen these "switches" they were regarded as belonging to a species of Alcyonoid Polyp. I expressed the belief that they belonged to a species of *Umbellularia*.

At a meeting of the California Academy, held on the evening of August 4, 1873, Dr. James Blake presented a specimen of the polyp of which these so-called switches are the axes, which had been sent to him from the Gulf of Georgia by his friend, Capt. Doane. This specimen was one of six or seven sent at the same time, all of which were in a tolerable state of preservation, though, as might have been anticipated, the more delicate tissues of the polyps are somewhat decomposed, and some of the specimens are in some places lacerated. They all are, however, sufficiently perfect to determine the true position, and show that the "switches" are, as was supposed, the supporting stalks or axes of an Alcyonoid Polyp "related or pertaining to the group *Pennatulidæ*."

At the last meeting I referred the specimen before the Academy to that division of the *Pennatulidæ* known as *Virgularia*, but upon a subsequent examination of the authorities, I find that those forms in which the axis is unilateral, or on one side, come within the Genus *Pavonaria* of Cuvier.

The only species heretofore described so far as I can learn, and on which this genus is based, is *P. quadrangularis*, of which a lengthy and interesting description from Prof. Forbes, is given in Johnston's British Zoöphytes (Vol. I, pp. 164–166). In that species, however, the axis is "acutely quadrangular," and the polyps are arranged in three longitudinal series, corresponding to three of the "angles of the stem."

In the specimen presented by Dr. Blake the style or axis is round, and the polyps are arranged in two longitudinal unilateral series, which conform to the convexity of the external fleshy covering. With these differences, I think I am justified in placing it in a new sub-genus for which I propose the name of *Verrillia*, in honor of Prof. Verrill of Yale College.

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*Printed in advance August 20th, 1873.

† *Vide* Proc. Cal. Acad. Sciences, vol. V, part I, pp. 7–12.

Genus PAVONARIA, Cuvier.

Sub-genus VERRILLIA, Stearns.

Polypidom linear-elongate, round, oval or ovate in cross-section. Axis round, slender, bony; polyps arranged in two unilateral longitudinal series.

Verrillia Blakei, Stearns; n. s.

Polyp-mass or polypidom, of a flesh or pink color, linear, elongate, attenuate; polypiferous portion about three fourths of the entire length, rounded oval to ovate-elliptic in cross section, and from three fourths to one inch in greatest diameter, flatly tapering toward the tip, as well as decreasing in the opposite direction to where the polypiferous rows terminate or become obsolete. From this latter point to the beginning of the base or root, a portion of the polypidom, equal to about one sixth of its entire length, is quite slender, being only about twice the diameter of the naked axis, and the surface quite smooth; said portion, as well as the base, is round (in cross section); the basal part is from one ninth to one eleventh of the entire length, and about one inch in diameter, with the surface longitudinally wrinkled or contracted, presenting a ridged or fibrous appearance.

Style or axis long, slender, white, hard, bony, somewhat polished, about three sixteenths (3-16) of an inch in diameter in the thickest part, tapering gradually toward the tip, and attenuated, with surface somewhat roughened toward the basal extremity. Enclosed in the polyp-mass or polypidom, the axis is central from the base to where the polyp-rows begin, when it soon becomes marginal or lateral, forming a prominent rounded edge (free from polyps) on one side of the polypiferous portion of the whole.

From near the sides of the axial edge the polyp-rows start, and run obliquely upward to the opposite side, where they nearly meet, presenting, when that side is observed from above, a concentric chevron or Λ-like arrangement, modified by the convexity of the polypidom. The more conspicuous polyp-rows show from nine to fourteen polyps, with occasional intermediate rows of three or more polyps.

The length of the most perfect of Dr. Blake's specimens was sixty-six (66) inches; of which, commencing at the tip, a length of forty-eight and a quarter (48¼) inches was occupied by the polyp-rows, which numbered two hundred and forty-five (245), or twice that number when both sides or arms of the chevron or Λ are considered. The number of polyps in each row was, in this specimen, from eight (8) to eleven (11), with occasional intermediate shorter rows of from three (3) to seven (7). Estimating ten to the row, this specimen exhibited about *five thousand* polyps, all of which, as well as the polyps in the other specimens, were filled with ova, of an orange color. In the next section of this specimen, the length between the last polyp-row and the swell of the base or root, is eleven and one quarter (11¼) inches; thence to the termination of the base, six (6) inches.

In some specimens, the polypiferous portion makes from one to two turns around the axis in its entire length. Plate IX, fig. 1, exhibits the general aspect of the species, reduced to a scale of one inch to the foot; fig. 2, a section of the polypiferous part of one of the oldest and largest specimens.

The average dimensions of thirty-six (36) of the axes in the Museum of the California Academy is five feet six and one third inches in length, and the diameter of the largest, nine thirty-seconds of an inch; diameter of smallest specimen, one sixteenth of an inch.

Dr. Blake's specimens were preserved in a mixture of glycerine and alcohol, and the more delicate tissue of the polyps appears to have been somewhat injured by the latter ingredient.

Additional specimens of the above species, from the same locality, have been received from J. S. Lawson, Esq.,* of the U. S. Coast Survey, by George Davidson, Esq., President of the Academy. These latter were put in glycerine only, and are in better condition than those received by Dr. Blake. Of the specimens received from Mr. Lawson, some individuals are younger than either of Dr. Blake's. In these the polyp-rows are farther apart, and there are not so many polyps in the row; neither do the ends of the rows approximate so closely on the side opposite the axial edge; the polyps being not nearly so many in the same length, or presenting (as do some of Dr. Blake's specimens) so crowded an appearance. In cross-section through the polypiferous portions, the younger individuals are less oval or acutely-ovate than in the older specimens. A comparison of individuals indicates an external differentiation, analogous to that displayed by specimens of the same species in Virgularia. The general aspect of this species, judging from the figure in Plate XXXI of Johnston's British Zoöphytes (2d ed.), is like *P. quadrangularis* from Oban, only in that species the rows of polyps, it is stated, are composed of "four, five or six polyps in a row," one figure showing seven.

I have named this species for Dr. James Blake, of San Francisco, author of many valuable scientific papers, to whom I am indebted for numerous courtesies.

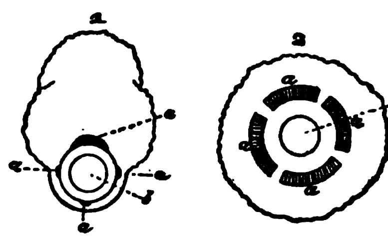
On the Structure of Verrillia Blakei.

BY JAMES BLAKE, M. D.

When engaged in examining the dry rods of the cœlenterate animal which has now been shown to be the axis of a *Pavonaria*, I found adhering to the basal extremity of some of the rods a portion of the soft parts, which in section presented a quadrate form somewhat resembling a Maltese cross. An examination of the specimens recently received affords an explanation of this form assumed by the basal portion of the animal, and shows how the symmetrical basal portion has given rise to the exceedingly unsymmetrical production

*The following remarks accompanied the specimens received from Mr. Lawson: "Obtained from fishermen by J. C. Hughes, Esq., of Burrard's Inlet, (Gulf of Georgia), at the request of Jas. S. Drummond, Esq., of Victoria, who kindly and keenly interested himself for me. JAMES S. LAWSON."

of the polypodion, which characterizes the more developed animal. A section of the basal portion a few inches from the lower end, and where the fleshy mass has attained its average thickness, shows that it consists of an ectoderm and endoderm, the latter surrounding a gelatinous mass immediately around the axis, which mass constitutes by far the larger part of this portion of the animal. The space between the two membranes is divided up into four distinct compartments, the division being formed by portions of the outer membrane, or ectoderm, dipping in and becoming attached to the inner membrane. An examination of the surface corresponding to the place where these processes are given off, shows that they correspond to a line of minute dots, arranged longitudinally, and which are either the remains of aborted polypes or possibly water pores, the rather imperfect state of the specimens not enabling me to determine this point. These canals are continuous the whole length of the stem, three of them in a very rudimentary condition, viz: those corresponding to the sides and free edge of the polypodion; whilst the fourth cavity contained in the large portion of the polypodion remains of a considerable size.



[Fig. 1, cross-section through polypiferous portion; *a, a, a, a,* canals. Fig. 2, section through basal part or root; *a, a, a, a,* canals, *b,* axis.] From this arrangement of the basal portion of the animal, I have no doubt that it commences its existence as a symmetrical quadrangular polype, with the polypes arranged linearly on the angles of the stem; and that this form continues as long as it does not grow more than a few inches above the bottom of the ocean. As, however, the stem becomes lengthened, its upper part is exposed to currents which would tend to bend the stem in one direction, and this would be followed by the abortion of the polypes growing on the most exposed side, and the subsequent development of the animal unsymmetrically.

Regular Meeting, Monday, September 1st, 1873.

President in the Chair.

Thirty-one members present.

Andrew F. Craven and John T. Brady were elected resident members, and Dr. Horatio S. Gates a life member.

Donations to the Museum: Specimen of a young *Octopus* (*O. punctatus* Gabb.), presented by Henry Chapman. Specimen of a young "Blue Shark," caught in San Francisco Bay, from S. R. Throckmorton. Bottle of Water from the Warm Springs at Point Isabel, Sonora (Mexico), presented by Capt. McDonald of the steamer "Newbern." Specimens of Reptiles and Wasp's Nest from Vancouver Island, by Henry Edwards; also, specimen of a Snake, presented by Mrs. Henry Edwards. Specimen of White Sandstone from Merced Lake, by George Davidson.

Professor Davidson remarked that the sandstone presented by him was from an extensive deposit in the neighborhood of Merced Lake, which is being worked; large quantities are taken out and shipped to the Eastern States for use as a polish; it was found superior to rotten stone for that purpose.

The following remarks were made:

On an Improved Leveling Rod.

BY GEORGE DAVIDSON.

In the regular work of the Coast Survey upon this Coast, but especially in some special examinations connected therewith, it became patent that the ordinary wooden leveling rod was inadequate to give perfectly reliable results. The defects are inherent in the instrument; the principal ones are:

a. inaccuracy of graduation;
b. uncertainty of the standard with which it was (if ever) compared;
c. no rate of expansion of the rod for changes of temperature;
d. no knowledge of the effect of hygrometric changes;
e. no means in the rod itself for adjusting the verticality;
f. no tangent motion.

For all ordinary work of leveling, the best made rods are sufficiently accurate; but where investigations are to be made for the coëfficient of refraction, so important in the hypsometrical of large triangulations, they do not afford the desired precision. In the reference of the mean level of the sea, at any point where years of continuous tidal observations have been made to some well-marked bench mark, the utmost precision is demanded, because by such observations, through a series of years or of centuries, we shall be able to measure the rising or subsidence of the shores of the Continent. When the hypsometrical work of a triangulation is carried across the country with the same precision as that of the sides and geographical positions, future observers will be able to determine the changes, if any, in the elevation of the interior of the Continent.

To effect this, I have devised a three-sided, hollow, rectangular metal casing, to fit over the graduated part of the "Boston rod." This casing is made up of three side and two end pieces of bell metal, planed to the thickness required, and brazed together. After all mechanical work is done upon it, the graduation is made and compared with the same standard of the United States as the measures of length are compared with. Its standard length is therefore determined for a specified temperature.

This casing fits over the front, sides and ends of the front part of the ordinary rod, and secured only at the bottom, so that it is free to change its length by changes of temperature, and is guided at the upper end by studs standing through in slots.

The extent of graduation is the same as that of the ordinary rod, and the verniers read to 0.001 foot, although they could be made to read to 0.0001 foot. To determine the temperature of the casing, a thermometer is set in a long slot in the front part, and the thermometer is read at each reading of the rod.

That the rodman may be able to keep the rod vertical, two small circular levels are attached to the back of the rod, one for the direct, and the other for the inverted position.

The ordinary back part of the rod is retained, and this compels to the assumption that the change of its length between any two sights, on account of change of temperature, is inappreciable, and this will virtually be the case in all except extraordinary changes of temperature, and even then effects will be much less than ordinary errors of observation.

The next important improvement I have added is a tangent screw; but this I will explain and exhibit at another meeting.

Mr. Stearns called attention to the fossil Tooth of a species of Elephant from Santa Rosa Island, presented some time ago by Mr. W. G. Blunt, as it proved that the island was formerly a portion of the main land. He had been informed by Mr. Blunt, that the tooth had been found *in situ*, and near it was embedded the tusk of an elephant; the latter so far decomposed that it crumbled, in the attempt to get it out.

Professor Davidson said that since the last meeting of the Academy he had examined the partially exhumed remains of a large animal near Lake Merced, which had previously been referred to by Mr. Hanks and other members, and which were supposed by some parties to belong to a whale; steps had been taken to secure the same for the Academy's museum.

The President stated that the Trustees had under advisement the questions arising from the terms of Mr. Lick's gifts to the

Academy, and had addressed to that gentleman a letter embodying their views. The Trustees desired Mr. Lick to remove some of the restrictions. Mr. Lick has as yet made no specific reply to the letter, but there is reason to hope that he will modify some of the terms.

Regular Meeting, Monday, September 15th, 1873.

Mr. Stearns in the Chair.

Twenty-six members present.

Louis Gerstle and Simon Greenwald were elected life members.

Donations to the Library: Am. Jour. Science and Arts for Aug. and Sept., 1873. U. S. Geological Survey of Montana, Idaho, Wyoming, and Utah, 1872; Hayden; from Dept. of the Interior. Monatsbericht der Konig. Preuss. Akad der Wiss. zu Berlin; Feb., March, and April, 1873 (two parts). American Naturalist, Aug. and Sept., 1873. First Ann. Report Public Library of Chicago, June, 1873. Sixth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology, 1873. California Horticulturist for Aug. and Sept., 1873. Bulletin of the Buffalo Society of Nat. Sciences; Vol. I, No. 2. Bulletin of the Essex Institute; Vol. V, No. 3. Am. Chemist, Aug., 1873. Engineering and Mining Journal, for Aug. and Sept. 2d, 1873. Proc. Acad. Nat. Sciences of Phila., 1873; pp. 281–296. Facsimile copy of the Maryland Journal and Baltimore Advertiser, for Friday, Aug. 20, 1773; also, copy of the Baltimore American of Aug. 20, 1873; from S. C. Gray.

Additions to Library by purchase: Zoölogical Record, Vol. VIII, 1871. Popular Science Monthly, Sept., 1873. Annalen der Physik und Chemie, No. 5; Leipzig, 1873. Annals and Mag. of Nat. History; London, Aug., 1873. Philosophical Magazine; London, Aug., 1873. The Journal of Botany; London, Aug., 1873. Astronomical Register; London, Aug., 1873. Nature; July 17, 24, 31, and Aug. 7, 14, 21.

Donations to the Museum: Specimens of Fossil Shells discovered while digging a well in the city of San Diego, presented by Henry Hemphill. Specimens of Shells and Pebbles, also portions of Skull of a Fish, from Pigeon Point and Pescadero; and twig of the California Nutmeg (*Torreya Californica*), from Redwood forest, on stage road between Redwood City and Pescadero; also

specimens of *Algæ;* presented by C. D. Gibbes. A pair of Japanese Vases, also a specimen of *Rupicola Peruviana*, Dumont, or "Cock of the Rock;" from Dr. F. Steindachner. Specimen of *Ceryle alcyon*, Boie., or Belted Kingfisher; presented by H. G. Bloomer. (This last specimen is preserved by Mr. Crane's embalming process, by Mr. Gruber.) Specimem of Cloth, being a piece of a garment found around an Indian skeleton, on Santa Rosa Island; presented by W. G. Blunt. Specimens of *Pimelodus Wagnerii*, Gunth, also *Basiliscus mitratus*, from the Isthmus of Darien; presented by S. A. L. Brannan. Specimens of fresh-water *Algæ*, from Mammoth Springs, Lassen County, Cal., persented by S. V. Blakeslee.

Mr. Bloomer remarked, that the specimens of *Algæ* presented had been found growing twelve feet under the surface of clear spring water.

Mr. Stearns, referring to the fossils presented by Mr. Hemphill, stated that the collection was exceedingly interesting, and numbered about sixty species, some of which are still living along the coast, while others are extinct. In a letter recently received from Mr. Hemphill, he says: "The new Water Company here has been sinking a well, twelve feet in diameter. At the depth of 100 feet they came upon a compact sedimentary deposit, such as is found on the bars in the bay at the present time; at the depth of 120 to 140 feet, a number of fine fossil shells were found, and my attention was called to them by Mr. D. O. McCarthy, one of the parties connected with the Water Company. I immediately began to prospect the dirt two or three hours each day, until a depth of 165 feet was reached by the diggers. The result has been 58 species. The collection shows the forms which existed in the bay when, very probably, its area was much greater than at the present time. The well is situated in a gulch about one mile from the bay, and back from the city."

Mr. Stearns remarked that no opportunity had occurred, since the receipt of the parcel on Friday last, to make a critical examination of the fossils presented by Mr. Hemphill. A partial inspection shows that they belong to the post-pliocene subdivision of the ter-

tiary period. He proposed to determine the species, and publish a list at an early day.

Remarks on the Upper Tuolumne Cañon.

BY ROBERT E. C. STEARNS.

Recent numbers of the *Overland Monthly* have contained contributions by Mr. John Muir, descriptive of the upper valley of the Tuolumne, and that portion of said valley known as the Hetch-Hetchy.

It is gratifying to know that Mr. Muir has found the valley not difficult of access, though at one time supposed to be so, after a partial effort made from an inaccessible point, by Mr. Clarence King.

In the above publication for August last, Mr. Muir says:

"Sometime in August, in the year 1869, in following the river three or four miles below the Soda Springs, I obtained a partial view of the Great Tuolumne Cañon, before I had heard of its existence. The following winter I read what the State Geologist wrote concerning it."

He here quotes from Prof. Whitney as follows:

"The river enters a cañon which is about twenty miles long, and probably inaccessible through its entire length. * * * It certainly cannot be entered from its head. Mr. King followed this cañon down as far as he could, to where the river precipitated itself down in a grand fall, over a mass of rock so rounded on the edge that it was impossible for him to approach near enough to look over. Where the cañon opens out again twenty miles below, so as to be accessible, a remarkable counterpart to Yosemite is found, called the Hetch-Hetchy Valley. * * * * Between this and Soda Springs there is a descent in the river of 4,500 feet; and what grand water-falls and stupendous scenery there may be here it is not easy to say. * * * Adventurous climbers * * * * should try to penetrate into this unknown gorge, which perhaps may admit of being entered through some of the side cañons coming in from the north."

Mr. Muir here resumes:

"Since that time I have entered the Great Cañon from the north by three different side cañons, and have passed through from end to end, entering at the Hetch-Hetchy Valley and coming out at the Big Meadows, below the Soda Springs, without encountering any extraordinary difficulties. I am sure that it may be entered at more than fifty different points along the walls, by mountaineers of ordinary nerve and skill. At the head, it is easily accessible on both sides."

I do not intend to question the motive or the taste of Mr. Muir's remarks, which might be regarded as a commentary on his quotation from the State Geologist, or to explain why Mr. King did not explore the valley *at the time* referred to. It seems to me reasonable to suppose that, upon the line pursued by Mr. King, the valley *was* inaccessible; and it is unreasonable to suppose that, if an experienced mountain-climber like Mr. King had really desired to enter the valley, he would have been deterred from doing so by obstacles of an ordinary character, as no person can with truth deny to him the possession "of ordinary nerve and skill."

This interesting region has been again visited this summer by Mr. Muir and several other persons, and will soon become familiar to an increasing number of tourists, from year to year.

On pages 428–9 of Volume I (Geology), in his "Report of Progress and Synopsis of the Field-work" of the Geological Survey, "from 1860 to 1864," Prof. Whitney, in commenting on the main geological and topographical features of this region, remarks:

"The vicinity of Soda Springs, and indeed the whole region about the head of the Upper Tuolumne, is one of the finest in the State for studying the traces of the ancient glacier system of the Sierra Nevada. The valleys of both the forks * * * * * exhibit abundant evidences of having, at no very remote period, been filled with an immense body of moving ice, which has everywhere rounded and polished the surface of the rocks up to the height of at least a thousand feet above the present level of the river at Soda Springs. This polish extends over a vast area, and is so perfect that the surface is often seen from a distance to glitter with the light reflected from it as from a mirror. Not only have we these evidences of the former existence of glaciers, but all the phenomena of the moraines—lateral, medial, and terminal—are here displayed on the grandest scale."

In a foot-note, on page 429, Prof. Whitney says:

"These glacial markings were *first noticed* by Mr. J. E. Clayton, and the fact of their existence was communicated by him to the California Academy of Natural Sciences, *several years ago.*"

(The italics are mine.)

At a meeting of this Academy, held on the 21st of October, 1867,* Prof. Whitney exhibited some photographs and stereographs,

* Vide Proc. Cal. Acad. Sci., vol. III, page 368; see also San Francisco *Evening Bulletin* of October 22d, 1867.

taken for the Geological Survey by Mr. W. Harris, in the Upper Tuolumne Valley, near Soda Springs, Mount Dana, Mount Hoffmann, and Mount Lyell. He also presented an account of a remarkable portion of the Tuolumne Valley (Hetch-Hetchy Valley), which forms almost an exact counterpart of the Yosemite, written by Mr. C. F. Hoffmann, the head of a party of the Geological Survey, by which it was explored the previous summer.

Dr. A. W. Saxe called the attention of the Academy to a locality which, from an archæological point of view, is very interesting, and which has never been examined to any extent. It is situated just south of the mouth of Laguna Creek, six miles north of Santa Cruz. Here is a mound, standing from 50 to 70 feet above the ocean level, composed of material which was in all probability collected by the aborigines of the country. It has a depth of from twelve to fifteen feet. He had examined only those parts which open towards the gorge. He had found deposits of various eras interspersed with what he regarded as drift sand, in which were to be seen all kinds of implements used by the aborigines, including the regular arrow-head, the crescent-shaped knife, and the long spear-head, in all styles of manufacture. What was of especial interest to him, was the discovery of tons upon tons of chalcedony rock, lying in the immediate vicinity, of the kind that is found below Monterey and about Pescadero. These boulders had an average diameter of four inches, the limits being two and a half and five inches. He thought that a ship-load of these rocks might be collected thereabouts. They were evidently carried thither from a very long distance, and he could form no conjecture as to where the aborigines got them from. They were probably obtained for the sole purpose of manufacturing implements.

Dr. George Hewston said the English sparrow had been a subject of inquiry. He could not see the reason for the introduction of a foreign sparrow which had some objectionable habits, when we had a most valuable native sparrow that should be protected—the Western white-crowned finch or sparrow. It frequents the neighborhood of gardens, builds in the city, and has a beautiful, sweet song. It is a little bird, often found sitting on the top of cedar trees and whistling at night. On Folsom Street, in his neighbor-

hood, through the spring and the early part of the summer, and often well through the year, this bird was to be found. It destroyed caterpillars innumerable,and it could be familiarized and made quite a domestic bird. A pair built in his garden some years ago, and reared a brood of four. He kept the brood in his study for some time, and the old birds fed them with caterpillars. During the whole time, the garden was free from noxious insects and worms. Afterwards the cats killed the birds, and the following season the garden suffered greatly from insects. Subsequently another brood located in the garden, and for two years he has not been troubled with insects.

Mr. Stearns said he believed that the reason why the English sparrow was preferred in the East, was that it destroys certain caterpillars, and especially the canker-worm, which some native birds will not touch.

Dr. Henry Gibbons, Sr., made some remarks in reference to ærial currents, and explained by illustrations on the blackboard his reasons for believing in a permanent upper current from the west towards the east; this is demonstrated by the course of high cirrus clouds; without discussing the proposed balloon voyage across the Atlantic, he thought the experiment of a voyage across the continent from the Pacific to the Atlantic should first be tried.

Mr. Stearns remarked that a similar suggestion had been made by Professor Henry to the æronaut Mr. Wise; but the latter had replied to the effect, that if an accident should occur, he preferred to fall into the water rather than upon the land.

Regular Meeting, October 6th, 1873.

President in the Chair.

Forty-three members present.

Dr. J. D. B. Stillman and George S. Ladd were elected resident members, and William Kohl a life member.

Donations to the Library: Catalogue of the Marine Mollusca of New Zealand, etc., Wellington, 1873, by F. W. Hutton, from James Hector, M. D., F. R. S., Director of the Colonial Museum. The Quarterly Journal of the Geological Society, London, August, 1873. Bulletin of the Essex Institute, 1873, Nos. 4 and 5. Arrangement of the Families of Mollusks, by Dr. Theodore Gill; Arrangement of the Families of Mammals, etc., by Dr. Theodore Gill; Arrangement of the Families of Fishes, etc., by Dr. Theodore Gill (3 pamphlets, 8vo.), Washington, November, 1872; prepared by Dr. Gill for, and presented by, the Smithsonian Institution. Engineering and Mining Journal for September, 1873. Overland Monthly for October, 1873, from the publishers.

Additions to Library by purchase: The Astronomical Register, London, September, 1873. Archiv für Naturgeschichte, Berlin, 1873. Annalen der Physik und Chemie, Leipzig, 1873, No. 6. The Annals and Mag. of Nat. History, London, September, 1873. The Journal of Botany, London, Sept., 1873. Nature, Vol. 8, Nos. 200, 201, 202.

Donations to the Museum: Carapace of the Tortoise-shell Turtle (*Caretta fimbriata ?*); also, specimens of the Pearl-oyster (*Margaritifera fimbriata* Dkr.) from the Gulf of California, and *Haliotis splendens* Rve., from the Coast of Lower California; presented by Capt. William Metzgar. Specimens of California Fishes (*Chimera Colliei* and *Anarrhichthys felis* Gird.), from Capt. C. W. Scammon. Specimen of Tarantula, from near Mount Diablo, California, by George W. Warfield. Skull of Flat-head Indian, from Kilisut harbor; specimens of Star Fishes; also, specimen of a Mollusk (*Eolis*), from Budd's Inlet, W. T. Petrified Wood, and Cast of Fossil Shell, from Neeah Bay, W. T. Sponges, from Cape Flattery, W. T. Specimens of Pecten (*Amussium caurinum*, Gould); *Machæra patula*, Dixon; *Hinnites giganteus*, Gray; *Placunanomia macrochisma*, Desh.; *Purpura crispata*, Chemn.; *Schizothaerus Nuttalli*, Conr.; and Chiton (*Mopalia Merckii*, Midd.), by James S. Lawson. Tarantula (living) and Nest, from Chinese Camp, Cal.; presented by Edward W. Harral. Piece of Wood from the Weskie Tunnel, Placer County, Cal.; also, portions of the Root of a Tree (petrified), from same locality; presented by

B. F. Ellis. Shells from San Pedro, Cal.; presented by George Davidson. Double-headed Snake, from Tuolumne County, Cal.; also, specimen of Petrified Wood (Mesquit?), from Prescott, Arizona; presented by Henry Edwards. Branch of California Nutmeg Tree (*Torreya Californica*), with Fruit, by A. R. Sausman. Specimens of California Fishes: *Chiropsis pictus*, Girard; *C. constellatus*, Girard; and *Pleuronichthys cœnosus*, Girard; presented by Dr. F. Steindachner. Lithographic Limestone, from Solenhofen, Bavaria; presented by Jacques J. Rey.

In connection with the piece of wood from the Weskie Tunnel, the donor states that "it is a portion of a log which was cut off in driving the tunnel, 350 feet from its mouth and 750 feet vertical distance from the surface of the ground. The log lies in auriferous gravel close to the bed-rock, and the portion not removed to make way for the tunnel still remains." The above specimen, which is exceedingly light, not being petrified, appears to be redwood (*Sequoia*). Of the portions of (petrified) root presented with the above, it is stated that they are "from the same tunnel, and within a few feet of the log"; and were found "imbedded in a seam of slate bed-rock," and "were broken from a root which had every appearance of having grown where he found it."

Mr. Stearns referred to the turtle-shell presented by Capt. Metzgar as belonging to the family *Cheloniidæ* and the genus *Caretta* of some authors (*Eretmochelys* of others); the carapace before us belongs to the so-called "hawk-bill turtles," and the large scales furnish the tortoise-shell so highly prized in the arts. The shelly-plates, preparatory to being manufactured, are washed, boiled, and steamed, and while moist and flexible are flattened by pressure. From the hole near the anterior portion of the shell, and just below the ridge, it is supposed that the turtles are procured by means of a spear, as other shells from the same region are similarly perforated. The flesh of the above species is not esteemed as highly as that of the green turtles (*Chelonia*) which belong in the same family, and are also found in the Gulf of California.

The President stated that the fossil remains near Lake Merced, referred to by him at a previous meeting, had been secured for the

Academy's museum, and had been recognized by Capt. Scammon as being the back portion of the skull of a hump-back Whale; it weighs 850 pounds.

Mr. Durand submitted a statement of daily thermometrical readings at Camp Cady, Cal., from and including May 25th to October 1st, 1872, showing the mean temperature for June to have been 101.5; July, 104.9; August, 105.1; September, 96.1 (Fahr.); the minimum being 80°, and the maximum reaching 114°. Camp Cady is on the Mohave River, in lat. 35 deg. N., long. 116½ deg. W.

Pacific Coast Lepidoptera.—No. 2. On the Transformation of the Diurnal Lepidoptera of California and the adjacent Districts.

BY HENRY EDWARDS.

In the hope of calling the attention of observers to the earlier stages of our butterflies, I have compiled from my own researches and from the best published material at my command, descriptions of all the larvæ and chrysalides of species belonging to the Pacific Coast, with which entomologists are at present acquainted. It is to be regretted that the list is so small, and that so little attention has hitherto been given to this interesting branch of study; out of 200 species of diurnal Lepidoptera inhabiting the Coast, only about 20 being known in the larval condition, and these being for the most part very briefly and imperfectly described. Thus, no species of either *Pieris*, *Anthocaris*, *Argynnis*, *Thecla*, *Lycæna*, *Satyrus*, or of any of the numerous forms of the *Hesperidæ*, has yet been noticed in its earlier stages, and the caterpillar of our common swallow-tailed butterfly (*Papilio Rutulus*), so abundant in every cañon during the spring and summer, is as yet unregistered and undescribed. The importance of these earlier conditions of insect life, in the discrimination of closely allied species, cannot be over-estimated, and it will be seen from the poverty of our present knowledge how large a field of interesting observation is open to the entomological student. The subjoined descriptions have been, in most cases, drawn up by myself from personal investigation of each species; but in one or two instances I have availed myself of the labor of others, for which due credit has always been given. A few species, such as *Vanessa californica*, *Pyrameis caryæ*, *Thecla californica*, and *Thecla irioides*, are well known to me, but I must defer their descriptions until some future day, as my notes upon these species have been mislaid or lost. In the Eastern States, the transformations of *Pieris protodice* and *Colias coesonia* are well known, though I cannot find any published description of either of them; while my friend Mr. T. L. Mead of New York was fortunate enough to raise the larvæ of *Pieris*

occidentalis and *Anthocaris ausoniedes*, descriptions of both of which species will shortly appear from the pen of Mr. W. H. Edwards of West Virginia, in his exquisite work on the Butterflies of North America. In the mean time, I respectfully ask the co-operation of all persons on this Coast, who are interested in the study of entomology, towards a better understanding of the transformations of these beautiful denizens of our woods and fields, assuring them that I will cheerfully credit them with any information they may supply to me.

The following species are noticed in the present paper:

Papilio Philenor,	Larva and	chrys.	*Melitæa palla*,	Larva and	Chrys.
" *Zolicaon*,	"	"	*Phyciodes mylitta*,	"	"
" *Asterias*,	"	"	*Grapta satyrus*,	"	"
" *Eurymedon*,	"	"	" *zephyrus*,	"	"
" *Rutulus*,	Chrysalis.		*Vanessa antiopa*,	"	"
Neophasia menapia,	"		" *Milberti*,	"	"
Colias enrytheme,	Larva and	Chrys.	*Pyrameis Huntera*,	"	"
Terias nicippe,	"	"	" *Cardui*,	"	"
Danais Archippus,	"	"	" *Atalanta*,	"	"
Melitæa chalcedon,	"	"	*Junonia coenia*,	"	"
" *Editha*,	"	"	*Limenitis Lorquini*,	Chrysalis.	

Limenitis Californica, Chrysalis.

Papilio Philenor. Fabr.

Larva. Head blackish brown. Body very dark brown, slightly shining, with two dorsal rows of long, fleshy processes, those near the anal extremity being the longest, bright orange red. A lateral row of processes, brown, reddish at base; those anteriorly being the longest. On the first segment are three orange red blotches, arranged almost in the form of a triangle. Spiracles orange red. Feet brown-black, red at their base. Under side dull flesh color. Retractile tentacles, bright orange.

Length, 2 inches. Width, 0.25 inch.

Food plant, *Aristolochia serpentaria.*

Chrysalis. Rather short, extremely broad in the middle, stone color, with a slight violet tinge. Truncate in front, with a very high protuberance on the thoracic region, two smaller ones on its sides, directed towards the head, and a double row of short dorsal protuberances toward the posterior region of the abdomen. Scattered over the upper surface are some pale, golden yellow patches.

There are two broods of this species; the first appearing toward the end of May, and the latter in August. From eight specimens of larvæ obtained at Saucelito, near this city, in April of the present year, I have had the following results:

Changed to chrysalis, May 11th–24th.

Imagos appeared, June 4th–14th.

3 ♂. 3 ♀. Two specimens are now alive in the chrysalis state, and will probably make their appearance early in the coming spring. The species is

remarkably common on Angel Island, near Saucelito, and throughout Napa and Sonoma Counties.

Papilio Zolicaon. Bdv.

Larva. Head pale bluish green, yellowish in front; eyes black with two black stripes in front, between each of which is a small black spot. General color of entire upper surface, pale, but very bright apple-green; slightly paler on the sides. First segment with one transverse black band and the suture black, with two small yellow points on each side before the anterior band, plate above the horn dusky. Second segment, with broad transverse black band, broadest on the back, with four anterior scallops, and a small yellow dot in each scallop, a long, transverse, lateral spot, yellow at the top. Third segment similar to second, except that the yellow spots on the transverse band are larger. Segments four and five, with transverse black band broken on each side by three yellow spots, below which is a rounded black spot. Segments six to nine inclusive, same as four and five, except that instead of the subventral round black spot there are two near the edges of the segments, with a third on the outside of each leg. Segments ten and eleven same as four and five. Segment twelve with a black anterior transverse line, with two yellow spots on the anterior margin, two rounded black dorsal spots, a posterior band, and a long black lateral spot over the anal feet. Prolegs pale bluish, black at tips, with black spot at the base of each. Anal feet dusky. Beneath pale bluish green, with broken median line of dusky marks, most prominent on the leg-bearing segments.

Length, 2.00 inches. Body tapering each way from the fourth segment, when seen from above. Viewed sidewise, the three anterior segments taper toward the head. I owe the above description to my friend Mr. R. H. Stretch, who has made an admirable figure of the larva. I find, however, that the insect is very liable to variations in its larval state; the transverse bands in many specimens becoming very broad, and the yellow spots obsolete in some of the segments, while in others the whole upper surface is pale green, with very faint black bands, and the yellow markings considerably larger. The above form may, however, be taken as the type.

Food plants. Various species of *Umbellifera*, but particularly *Fœniculum vulgare*. In confinement, the caterpillars will feed readily upon the common carrot of the gardens. There appears to be but one brood of this species, the larvæ being fully fed about the middle of September, and the imago appearing in the following May.

Chrysalis. Fawn color, shading into blackish brown at the sides and dorsa region, and mottled irregularly underneath with the same color. Head deeply notched in front, thus forming two protuberances on the sides in front, these being very rough, and intensely black in color. Thorax also with black dorsal protuberance, and a lesser one on the sides. On the fifth, sixth, seventh, and eighth segments are two small, black points, convergent toward the anal extremity. The chrysalis, like the larva, is subject to great variations, some speci-

mens being almost wholly black, with shadings of fawn color, while others lose the black altogether, and are fawn color, with pale brown markings.

Papilio Asterias. Fab.

"*Larva.* Apple green, with a transverse band on each segment, formed of alternate bands of black and yellow, excepting on the first three, where the black band is interrupted by the yellow points only toward the spiracles; whilst on the back, the yellow points are placed before the black band; three black points on the anterior part of the first segment, and two black lines on the head. The feet have black points at their base.—Feeds on *Daucus carota*, *Anethum fœniculum*, and other umbelliferous plants."—Boisduval.

Chrysalis. Very similar in size and shape to that of *P. Zolicaon*, but differing in its lighter color, and the absence of the dark shading on the dorsal and lateral regions.

The perfect insect has occurred in Marin County, and a fine specimen was taken some years ago near Oakland by Mr. Jas. Behrens; so that the larva may be sought for in these localities.

Papilio Eurymedon. Boisd.

Larva. Head pale brown, with a fleshy tinge. Entire upper surface of body pale apple green, with the following markings. The first segment has its anterior margin broadly yellow. The third segment is much thickened, with its posterior margin broadly yellow, surmounted by a row of small black dots, and in front with a series of about six irregular yellow patches, edged with black, enclosing a black spot with a yellow centre. Between the third and fourth segments is a broad black band, which is concealed by the margins of the segments at the will of the insect. On the fifth and sixth segments are two blackish dots, and on the seventh, eighth, and ninth are four black or purplish dots. Feet, prolegs, and entire under surface, greenish white. Body tapering very much posteriorly from the third segment. Retractile horns bright orange. When irritated, the insect draws in its head, folding it almost so as to be concealed by the first segment, and swelling out the third in front, it presents a most grotesque appearance: the horns being protruded, and the curious yellow markings, which have some resemblance in form to a pair of spectacles, representing eyes. It must under these circumstances be a very formidable looking monster to its insect enemies.

Food plant, *Frangula californica.*

Chrysalis. Long, tapering very much toward the anal extremity, which is very sharply pointed. Color, pale fawn color, with dashes of black and brown very irregularly scattered over the entire surface, a little more intense and connected at the sides. The protuberances of the head and thorax are brown, mottled with dirty white, and the seventh, eighth, and ninth segments have each two raised black dots. The spiracles, which are distinctly seen, are dark brown. The under side is marked with dashes of brown and black, irregularly

placed. In some individuals, the ground color of the chrysalis is very pale green. Larvæ found in August changed to chrysalis in September, and the perfect insects appeared in the following Spring, one specimen emerging as early as the 23d of February.

Papilio Rutulus. Bois.

I regret that at present I can say nothing with certainty respecting the larva of this very common species, but it is reasonable to expect that our ignorance of its transformations cannot long continue.

Chrysalis. Remarkably like that of *Eurymedon.* The markings are, however, certainly more regularly disposed, and assume the form of stripes and rows of spots and lines. On the seventh, eighth, and ninth segments also, the raised black dots are distinctly larger, and a double row of them is invariably plainly visible. I remark this character in five specimens of the chrysalis which I have found, all of which have produced the true typical *P. Rutulus.* Beyond the more regular arrangement of the markings, and the presence of two black, raised dots on the segments referred to, I can discern no difference in the chrysalis state of *P. Rutulus* and *P. Eurymedon.*

Neophasia menapia. Felder.

Larva, ignota.

Chrysalis. Very long and tubular, with the beak sharply pointed, slightly thickened toward base of abdomen. A small ridge-like protuberance on the thorax, and a smaller one near the head. Color immediately after change, pale yellowish green, with three narrow dorsal stripes, silvery white. The lateral stripes enclosing the stigmata, are a little broader, and bent upward anteriorly. Stigmata brownish. The neuration of the wings is plainly seen, and at their base is a well-defined black spot. Toward the period of emergence, the chrysalis loses its bright green color, and becomes of a dark olive hue, almost black above, the silvery tone of the stripes changing to dirty white, the coloration of the wings and various organs being more distinctly seen. The chrysalis is attached to the trunks of pine and fir trees, with the head invariably directed upward, and to the fronds of *Pteris*, with the head always toward the point of the frond.

Length, 0.80 inch. Width, 0.15 inch.

I was fortunate enough to discover the chrysalis of this highly interesting species during a recent trip to Vancouver Island, but the most diligent search did not reward me with the caterpillar. It doubtless feeds upon the Douglas spruce fir (*Abies Douglassii*), and should be sought for in the early part of July.

Colias eurytheme. Bois.

With reference to this species, I extract the following from Mr. W. H. Edwards' "Butterflies of North America."

" *Colias Eurytheme.* From Mr. Hayhurst I have received an admirably executed drawing of the egg, larva and chrysalis of this species. The egg is long, fusiform, and ribbed longitudinally. Length of mature larva, 1.4 inch; cylindrical, tapering posteriorly from eleventh segment; head green, translucent, body dark green, somewhat pilose, each segment transversely creased; a narrow, white, lateral band, from second to last segment, through the middle of which runs a broken line of vermillion red. The larva is a little longer and larger than that of *C. Philodice*, which it much resembles, but is without the series of semicircular black spots next under the lateral band, usually seen on the latter. The eggs were deposited on Buffalo grass (*Trifolium reflexum*), and the larvæ fed thereon. Chrysalis .95 inch in length, cylindrical, tapering to a point posteriorly; the head case also produced to a point; mesonotal process rounded and not very prominent, a whitish lateral line runs from wing cases to extremity of abdomen, above which is a black stripe that crosses two or three of the upper abdominal segments. The shape differs from that of *Philodice*, in the attenuation of the head case and lesser prominence of the process; also in the absence of the abdominal markings. This description, however, is given from the drawing."

Terias nicippe. Fabr.

"*Larva.* Pale green, with a dorsal ray more obscure, and a lateral white band, marked before with five yellow points."—Boisduval.

Food plants, various species of *Cassia* and *Trifolium.*

Chrysalis. Dull pale green, with the beak very sharply pointed, the entire surface sprinkled over with ferruginous spots. Wing region largely developed, the edges forming a sharp arcuate protuberance.

This species, so common in the Southern States and Mexico, must now be included in the list of Californian Butterflies, Mr. J. Behrens having during the past Summer received several specimens from San Diego.

Danais Archippus. Fabr.

Larva. Dull cream white, each segment banded regularly with black and yellow, thus forming alternate bands of black, yellow and white throughout the entire length, the white bands being broadest, and crossed transversely at their middle by the black bands. The yellow bands are also crossed transversely by a narrow line of black. The head and two posterior segments are devoid of white. The second segment has two long, black, fleshy processes, and the eleventh segment two shorter ones of similar form. Feet black, whitish at their sides. Under side of body dirty white.

Food plants, various species of *Asclepias.*

Chrysalis. Bright yellow green, almost pellucid, and resembling green ice. Short, and very much rounded. Thoracic protuberances small. In front on

the third segment are some small golden points, and behind the middle is a semicircle of gold, bordered below by a range of small, black dots.

Melitæa chalcedon. Bois.

Larva. Velvety black, finely irrorated with white. From third segment to last, seven rows of thick, many-branched spines, the dorsal row orange, the others blue-black, those of second lateral row rising from tuberculated orange spots.

Head black, bilobed, compressed, furnished with simple black spines. Feet and prolegs black. Under side of body dull flesh colored.

Food plants, *Scrophularia Marylandica* L., *Diplacus glutinosus*, *Mimulus luteus*, *Lonicera sp.*, and the various species of *Castelejia.*

Length, 1.05 inch.

Chrysalis. Pearl-white, irregularly marked with points and patches of dark brown. On the abdominal region are several rows of orange spots, the same color appearing in the covering of the wings.

Melitæa Editha. Bois.

Larva. Dull black, with seven rows of many-branched spines, all of which have a bluish tint. Those of the second lateral row arise from tuberculated orange spots, as in *M. chalcedon*, but the dorsal row of orange spines, so characteristic of that species, is wanting in *Editha.* Feet and prolegs brown, inclining to a fleshy tinge.

Food plants, *Erodium Cicutarium*, various species of *Trifolium* and *Viola.*

Chrysalis. Cylindrical, shorter and rounder than *M. chalcedon.* Ground color dull cream-white, each segment with a transverse regular row of orange spots, bordered anteriorly by black dashes. On the wing covers are some broad, black, waved lines, and some black patches about the head and thoracic region.

Melitæa palla. Boisd.

Larva. Dull black, with a double dorsal row of orange spots, forming, when viewed longitudinally, two interrupted lines. In the spaces between the spots, are some irregular white patches. Along the sides are two similar double rows of orange blotches, with white spaces about the spiracles. The spiracles themselves are black. Each segment is provided with five rather long spines, from each of which project about sixteen or eighteen long black hairs. The base of each spine is surrounded by a dirty white ring, and some minute white irrorations are scattered over the whole upper surface between the spines.

Head rather small, black, very glossy. Feet ash color, banded with black.

Length, 1.05 inch.

Food plant, *Castelejia breviflora.*

The caterpillars feed chiefly on the flowers, and are solitary in their habits,

only one being usually found on each plant. From ten larvæ taken in May, 1873, I obtained the following results:

Changed to chrysalis, May 16th–23d.

Imago, June 4th–13th.

Five ♂, four ♀; one died in chrysalis state.

Chrysalis. Fawn color, very faintly marked with pale brown dots and dashes over the entire surface. On the thorax are two raised, shining points, and each of the segments, except the two last, possesses a treble row of small, shining tubercles.

Phyciodes mylitta. Edw.

Larva. Head small, bronze black, entirely covered with short black hair. Viewed from above, the whole upper surface is velvety black, each segment being provided with six tubercular spines, very hairy to their tip. The lateral row of spines is dull ash color, with black hairs, the spines being shorter than those of the dorsal region. Feet and prolegs dull ash color, the under side of the body with a fleshy tinge.

Length, 0.75 inch.

Food plants, various species of *Carduus.*

This species is gregarious in its habits, and terribly destructive to the plant on which it may be hatched, in many cases only the nerves of the leaf remaining. The caterpillars spin a small web, and draw the leaves of the plant together.

Chrysalis, ash color, with a slight metallic reflection. Dorsal region with three rows of slightly raised tubercles. Anal extremity much incurved. Out of sixteen specimens taken on May 8th, three died in larval state, the rest transformed as follows:

Chrysalis, May 26th–June 5th.

Imago, June 6th–19th.

Ten ♂, three ♀.

Grapta satyrus. Edw. (Figured in "Edwards' Butterflies of North America.")

"*Larva:* Head black, angular, bilobed, spiny, and with a spiny tubercle at each of the upper angles; color of body black, with a broad greenish white dorsal stripe, which on the anterior segments is clouded with black; on each segment, on this stripe, is a fine V-shaped black mark, having its angle at the dorsal spine. The spines form seven rows, the dorsal greenish white, wanting on the first four segments, the first lateral row of same color, present on all segments from the second; the second lateral row black, the third greenish white, wanting on the first four and terminal segments, and springing from an infra-stigmatal line of the same color; and the spines are thinly covered with short, bristling, concolored hairs, except that those near the tips of the white spines are blackish."—R. H. Stretch.

Food-plant, *Urtica sp.* (Stinging Nettle.)

The above description was taken by Mr. Stretch from some specimens found by me at Congress Springs, Santa Clara County, in June, 1871. I only raised one specimen out of three; but the following year I was fortunate enough to perfect three other specimens, and recently, in Vancouver Island, four others, the markings of the larva state being remarkably constant in every instance.

Chrysalis, fawn-color, with a few darker markings irregularly placed. On each side of the abdomen, near its base, are three small semi-oblong silver spots, the posterior one with a trace of gold upon it. Thoracic protuberance large. Beak produced into a sharp point.

Changed to chrysalis, June 20th–26th.

Imago appeared July 4th–18th.

Grapta zephyrus. Edw.

Larva: Body furnished with six rows of many-branching spines; the segments, from second to eighth inclusive, bright buff inclining to orange, remaining segments pure white. Along the sides are two waved orange lines, uniting irregularly; the interspaces, which are buff or white according as they are anterior or posterior, are marked with black dots; above the orange lines are some faint black lines, and some black patches are discernible at the base of lateral spines. Spiracles black, broadly bordered with white. Head black, with short black spines at vertices. Under side of body dull flesh-color. Feet and prolegs with pinkish tinge. Length, 1.05 inch.

Food-plant, *Azalea occidentalis*.

Chrysalis, pale brown, the general shape as in *Comma*, but the mesonotal process more prominent and rounded, the palpi cases more produced and compressed at the base, the upper tubercles silvered.

The larva from which the above description was taken was found by me in the Yosemite Valley, July 3d, 1871. Changed to chrysalis July 29th, the perfect insect emerging on the 15th of August. The species is very common near Virginia City, Nevada, and in many of the warm valleys of the Sierra.

Vanessa antiopa. Linn.

Larva, velvety black, entire surface covered with white irrorations. A deep black dorsal line; each segment provided with four spines, the inner ones being branched, the outer ones simple; the second segment is, however, destitute of spines. At the base of the seven middle bundles of spines is a reddish-chestnut tubercular patch. Head black; prolegs black; feet chestnut, fleshy beneath.

Length, 2 inches.

Food-plants, various species of willows, and occasionally on rose-bushes.

Chrysalis, brownish gray, with some darker markings. Palpi cases produced into a sharp spine. Thorax with three spines on its dorsum, the middle one large and slightly recurved, two minute ones near its base. The sides of the thorax are produced into a ridge, armed with two spines. Wing-cases also with a small spine toward their extremities. The third and fourth segments are pro-

vided with two spines each, the fifth, sixth, seventh, and eighth with three spines, the middle row being extremely small.

Length, 1 inch.

Vanessa Milberti. Godt.

Larva, dull olivaceous, with blackish tinge, whole surface covered with indistinct black dots. A narrow, black dorsal line. The sides below the stigmata are stone color. Each segment is armed with five black spines, from which spring some short black hairs. Stigmata inclosed in waved, irregular black band, with a pale pinkish space above and below it. Stigmata black, encircled with dull white, or stone color. Head and prolegs black; rest of the under side stone color.

Length, 1 inch.

Food-plant, *Urtica sp.* (Stinging Nettle.)

Chrysalis, dull ash color, with darker dots scattered irregularly over the whole surface. Thoracic protuberances almost obsolete. Palpi cases produced into a short, sharp spine. Abdominal region with three rows of short, shining points, slightly silvered at the tip; there is also an indistinct dash of silver at the base of the head. Wing cases paler in color than the rest of the body. Length, 0.75 inch.

Pyrameis Huntera. Sm. Abb.

Larva, blackish gray, striated with yellow, the first four segments more obscure than the remainder. Along the feet, and below the stigmata, is a yellow lateral ray, and above these is another yellow ray, marked with a small orange spot above each stigma. Stigmata brownish. All the spines are yellow.

Food-plants, various species of *Gnaphalium.*

"*Chrysalis*, yellowish, moderately angular, scattered with a large number of golden spots."—Boisduval.

Pyrameis Cardui. L.

Larva, brownish, with four yellow interrupted lines, two dorsal and two lateral. Head greenish black. The third and fourth segments have four spines each; the fifth to the eleventh, inclusive, have seven spines each; the twelfth has four spines, and the thirteenth only two. The spines are brownish black." —Stainton.

Food plants, various species of thistles. (*Carduus*, *Cnicus.*)

The larva is solitary in its habits, and draws up the leaves on which it is feeding with its threads.

"*Chrysalis*, grayish brown, angular, scattered over with golden spots, which sometimes cover nearly the whole surface."—Morris.

Pyrameis Atalanta. Linn.

Larva, yellowish gray, with a pale yellow lateral line. Third and fourth segments with four moderate blackish spines; the fifth to twelfth segments, in-

clusive, with seven spines. Between the second and third row of spines is a row of black V-like marks. Head and legs black; prolegs reddish. The ground color is rather inclined to vary, being frequently of a violet hue; it then appears as if powdered with gray.

Food-plant, *Urtica sp.* (Stinging Nettle.)

The caterpillar, according to Sepp, shortly after it is hatched, selects a nettle-leaf, which it draws together with threads into a roundish hollow form, leaving for the most part an opening into the interior both before and behind—thus serving both for shelter and food until almost devoured, when it selects a fresh leaf, and proceeds with it in the same manner; one caterpillar only being found on a single leaf—thus indicating a peculiar liking for a solitary life; a circumstance confirmed by the eggs being laid solely and apart, whereas caterpillars hatched from eggs deposited in clusters are gregarious. The caterpillar state lasts about five weeks.

"*Chrysalis*, blackish, moderately angular, covered with a grayish efflorescence, and ornamented with golden spots."—Boisduval.

Junonia coenia. Hubner.

Larva, blackish, pointed with white; lower side of abdomen and feet fulvous. It has two lateral white lines, of which the upper is marked with a row of fulvous spots.

"*Chrysalis*, like those of *P. cardui* and *P. Huntera*, but blackish, varied, and whitish, without any metallic spots."—Boisduval.

The above description is too brief, but, in the absence of specimens from which to draw up a more complete one of this familiar insect, I am for the present compelled to be contented with it.

Limenitis Lorquini. Bois.

Chrysalis, dull fawn color; shining. Palpi cases very short. Thoracic protuberance rather short, triangular. The two basal segments of abdomen produced dorsally into a high semicircular process, flattened at the sides. The fifth, sixth, seventh, and eighth segments have each a black, shining, raised point at their posterior margins, and a black oblique dash is also seen at the junction of the wing cases with the abdomen. Length, 0.85 inch.

Limenitis Californica. Butler.

Chrysalis, short; very much thickened over the wing cases, tapering abruptly to the anal extremity. Dark fawn color, with occasional brown markings. The palpi cases are long, curved downward in front, and black at their tips. Wing cases broadly margined, especially toward their extremities. Thorax with very short, blunt process. On the base of the abdomen is a high protuberance, notched in front, which runs into a longitudinal ridge toward the anal extremity. Wing cases pale, showing the coloring of the wings. The chrysalis

is attached to the trunks of trees by a large silken web, not less than half an inch in diameter.

Length, 0.80 inch.

Dr. Blake exhibited the fossil-tooth of a species of Shark, which was found near Martinez, probably in the cretaceous rocks. The tooth belonged to a species of *Carcharodon*, and its specific characters indicated *C. subauricularis;* when entire, this tooth probably measured five inches in length on the edges and three and a half inches broad; the animal to which the tooth belonged quite likely measured as much as sixty feet in length.

Mr. Bloomer read the following:

Note on Alexia setifer and its Allies.

BY J. G. COOPER, M. D.

In vol. IV of our Proceedings, pp. 150 and 171, I described some new Californian Mollusca very briefly, and referred to others by name, as "soon to be published with illustrations." ,Having some months before sent the manuscript and figures to the *American Journal of Conchology*, Philadelphia, I supposed that they would be published before the notices in our Proceedings. It happened, however, that they were delayed so long on the way that the Journal completed its seventh volume and was then suspended, the Philadelphia Academy of Sciences assuming the publication of such articles as had been published by the Conchological Section in the form of a special journal. It thus happened that the notices in our Proceedings had priority of publication by nearly or quite six months, as far as the *Alexia* is concerned; while the meeting at which the description was presented took place six months before its publication. The other species referred to were named *without description*, at a meeting held Dec. 19th, 1870, and published in April, 1871, fifteen months before their appearance in the Philadelphia Proceedings. I merely refer to these dates, not as a question of doubtful priority, but to show why no reference is made in either publication to the other, and to indicate the difficulties a describer meets with in having his work published two thousand miles away.

Another more important object is, to explain why a very serious error may have been committed in describing the *Alexia* as new. The latest work on American species was W. G. Binney's compilation on "Land and Freshwater Shells," Part II, Sept., 1865, (Smithsonian Institution, Washington, Misc. Coll., No. 143), which was supposed to contain all references bearing on the species of the North Atlantic, together with full descriptions. It appears, however, from the last volume of "Jeffreys' British Mollusca," which had not

reached us at the date of first publication, that the European *A. myosotis*, considered by Binney identical with the New England form, has the same character in the young on which I relied for distinguishing *A. setifer*, namely, a row of bristles near suture, and that it had even received long ago the name of *Melampus ciliatus* in France, from that character. This fact being omitted by Binney led me to distinguish our form as new; but I confess that there is no other character sufficient to distinguish so variable a shell from the European form of *A. myosotis*, although it may still prove that the Eastern American species, described as *Melampus turritus*, Say, *M. borealis*, Conrad, *Leuconia, Sayi*, Kuster, etc., is distinct.

Professor Davidson exhibited his improved leveling-rod, and described the method of operating it.

The President called attention to a new and improved sounding apparatus, invented by Commander George E. Belknap, of the U. S. steamer *Tuscarora;* by the method employed, a quantity of the bottom mud can be brought up, as well as a sample of water from the lowest depths. This has heretofore been difficult, if not impossible.

*On the Height of Mount Whitney.

BY W. A. GOODYEAR, C. E.

Mr. M. W. Belshaw, who on the 27th day of July, 1873, climbed with me the mountain which for several years has been taken for Mt. Whitney, has since then succeeded in obtaining a barometric measurement of the altitude of the genuine peak, Mt. Whitney itself.

He volunteered to pay the expenses of a party to attempt the ascent, and that party reached the summit of Mt. Whitney on the sixth day of September, 1873, and obtained a series of ten observations there, extending from 9.20 A.M. to 2 P.M., taken by Mr. Charles Rabe, an attaché of the State Geological Survey.

On the same day a series of observations, nearly simultaneous, was taken at Lone Pine with another barometer.

The altitude of Mt. Whitney above Lone Pine, as computed by me from the mean of these observations, is 10,981.5 feet.

Add to this the best determination of the altitude of Lone Pine yet made,

* The accompanying sheets give the observations from which I computed the altitude of Mt. Whitney at 10,981.5 feet above Lone Pine. That result was obtained with Williamson's tables, in the following manner:

In the first place, all the observations were reduced to 32° F., and the correction of No. 1358 to standard on Sept. 6th then determined. This correction was —.003. The correction of No. 1554 to standard was then determined for August 31st, the middle day of the period over which the comparisons with this instrument extended. This correction was +.013. There

which is also barometric, and which is 3,917 feet, and we have 14,898.5; or say in round numbers, 14,900 feet for the absolute altitude of Mt. Whitney above the sea.

I wish to correct one error in my article of August 4th, read before the Academy.

The magnetic bearing from the peak which Mr. Belshaw and I climbed to Mt. Whitney, is there given as N. 67° W.

It appears from subsequent comparisons with the maps, and with other observations, that that bearing, together with five or six others out of some twenty which I took at that time, was affected by a large local attraction due to magnetic iron, distributed with great irregularity through the granite.

Not being able to see from any one point on that peak all the points to which I wished to take bearings, I moved the compass two or three times within a radius of 25 or 30 feet. But the compass always rested on the rock. The result happened to be that all the bearings taken from one of the points (that to Mt. Whitney included), were affected by local attraction, while the rest were not. The real magnetic bearing to Mt. Whitney is about N. 53° W.

This error affects also the triangulation by Mr. Belshaw, whose results are given in the note to that article, and which was based upon the bearing of N. 67° W.

The barometric altitude of Mt. Whitney, as given above, should be subject to slight correction, owing to the fact that I do not know the horory curve for Lone Pine, and that nobody knows the horory curve for the summit of the peak; but any correction from this cause would be small.

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being no further comparisons with this instrument, which is a short one, it was assumed that its correction remained the same on the 6th of September.

Next, in the series of readings at Lone Pine, I interpolated other readings, both of the barometer at 32°, and of the detached thermometer, so as to obtain a series of ten readings for Lone Pine at times respectively simultaneous with the observations on the peak. The remaining readings at Lone Pine were rejected in the computation. The series of ten readings for Lone Pine so obtained, together with the series of observations on the peak, were then corrected to standard. This done, the mean of all ten readings for each locality was taken, both of the barometer and the detached thermometer; and from these means, the altitude in question was computed. These means were as follows:

	Barometer.	Detached Thermometer.
At Lone Pine	26.362	89.2
On Mt. Whitney	17.835	35.3

If, instead of taking the mean of all ten observations, the successive pairs of simultaneous readings be taken separately, and the computation made for each pair respectively, there will be found to be at different hours a large variation in the "temperature term" of the formula, and the results so obtained will range through something like a hundred feet variation of altitude, or from about 10,900 to a little over 11,000 feet. This is due to the large range of the thermometer in the valley, which was far greater than on the peak. The result given by the mean is much nearer the highest than the lowest of the individual results, because during the first hour of observation on the peak, the thermometer in the valley rose rapidly, while after 10.30 A. M., the change was not so rapid.

The altitude of Lone Pine itself—3,917 feet—was obtained from Prof. Whitney, and is the result of our observations there for a week or so in 1870. The altitude of the peak above Lone Pine, obtained in the manner indicated above—10,981.5 feet—is probably as close an approximation as these observations give the means of making, without a knowledge of the horory curves or monthly variations at the localities.

Barometer No. 1358 at Lone Pine, September 6th, 1873. Observations by R. A. Loomis.				Barometer No. 1554 at Summit of Mount Whitney, September 6th, 1873. Observations by C. Rabe.			
Time.	Barometer.	Attached Thermometer.	Detached Thermometer.	Time.	Barometer.	Attached Thermometer.	Detached Thermometer.
A. M.				A. M.			
6.45	26.464	60.	62.	9.20	17.848	38.	33.
10.00	.518	83.	82.	10.00	.836	37.	33.5
10.30	.516	87.	88.	10.30	.835	37.	34.5
11.00	.520	89.	90.	11.00	.836	38.	35.
11.25	.518	91.	91.	11.30	.840	40.	34.5
P. M.				M.			
12.45	.516	92.	92.	12.00	.848	42.	36.
1.35	.484	93.	94.	P. M.			
2.45	.462	91.	92.	12.45	.846	41.	36.
3.15	.450	90.	91.	1.00	.840	42.	36.5
4.10	.444	89.	90.	1.30	.838	43.	38.
5.45	.426	84.	86.	2.00	.838	42	36.

The President reported progress in the matter of the modification of the terms of the deed from James Lick to the Academy, and stated that Mr. Lick had so changed the conditions of the first deed, that the Academy would have several years, and therefore ample time, to raise the money for the erection of a proper building.

Regular Meeting, Monday, October 20th, 1873.

President in the Chair.

Thirty-three members present.

Dr. H. Behr, W. W. Russell, Isaac E. Davis, Philip Caduc and C. H. Whitesides were elected resident members; Andrew B. McCreery a life member; and Stephen Powers, of Sheridan, Placer County, a corresponding member.

Donations to the Library: California Horticulturist for October, and Overland Monthly for November, 1873, from J. H. Carmany & Co. Engineering and Mining Journal, October 7th. Nature (No. 204). Catalogue of New York State Library, 1872. Twenty-fourth Annual Report of the New York State Museum of Natural History. Twentieth, Twenty-first and Twenty-second Annual Reports of the Regents of the University of the State of New York, on the Condition of the State Cabinet of Natural History. Fifty-fifth Annual Report of the Trustees of the New York State Library.

Donations to the Museum: Specimen of Cloth from a submerged wreck, bored by the Teredo, presented by D. J. Staples; also, a similar specimen from Dr. George Hewston. Specimen of *Tarantula* from ———. Specimens of pre-historic Stone Implements, from near Mount Shasta, presented by B. P. Avery. Coal from the Rocky Mountain Coal Co.'s Mine, also a piece from Fort Scott Coal mine, Kansas, presented by D. D. Colton. Specimens of *Octopus;* also of *Chimera* and other fishes from San Francisco Bay, by S. R. Throckmorton.

Mr. B. P. Avery remarked that the specimens of Stone Implements presented by him were from Strawberry Valley, at the southern base of Mount Shasta. One, a pestle, made from the trachyte of which the bulk of the mountain is composed; the other, a smooth oblong stone used in dressing skins, made of the red lava overlying the trachyte, and covering the flanks of the mountain. These implements were dug up from a slight depth by J. H. Sisson, the Shasta guide, while cutting a ditch. Mortars and pestles of trachyte have frequently been found along the banks of the upper Sacramento; but no other instance is known of the use of lava in the manufacture of Indian implements. Obsidian, however, is largely employed, or used to be, for arrow- and spear-heads.

Professor Davidson delivered a lecture on the discovery and progress of Spectrum Analysis; and Mr. Hanks explained the construction of the Spectroscope, illustrating the remarks of Professor Davidson and himself, by numerous experiments.

REGULAR MEETING, MONDAY, NOVEMBER 3D, 1873.

Vice-President in the Chair.

Forty-five members present.

Robert W. Andrews, E. G. Waite, Thomas Adam, and Henry Michaels were elected resident members, and Joseph A. Donohoe life member.

Donations to the Library: De la Nature et Povrtraict des Poissons, by Pierre Belon; a curious old work, printed in 1554 by Henry Estienne; presented by Rev. Albert Williams. Voyage de découvertes de l'Astrolabe, twenty-two parts (text) and five folio volumes of atlas and plates; also, Voyage autour du Monde sur la corvette La Bonite, in seventeen parts (text) and three folio volumes of plates; the latter including plates of the expeditions of the frigates *Venus* and *Ocean*. The above valuable addition to the Library is made by a "Friend" of the Academy through Dr. George Hewston, who remarked: "one of the difficulties which all students of natural history have to encounter on this coast is the deficiency of works of reference. Having stated this fact to a friend, whom I accidentally met in a book store, he with his accustomed liberality, which only equals his modesty, at once responded to my solicitation, and has afforded me the pleasure of donating this magnificent set of voyages to the Library of this institution; and I regret that he has placed a ban upon my announcing his name to the Academy. Hoping that these beautiful drawings will add to the advantages of our institution and assist the student of nature in his pursuits, I commit them to your care." A special vote of thanks was unanimously voted by the Academy, and Dr. Hewston was requested to present the same to the donor.

Donations to the Museum: Skull (of a Kanaka?) from an old battle ground on Mauna Loa, S. I. Five specimens (two species) of Crabs, from near Shanghai, China; presented by Henry Edwards. Jacket, made from skins of the entrails of seals, from

Alaska; presented by B. R. Swan, M. D. Fossil Wood, from the "petrified forest" at Calistoga; by S. A. L. Brannan. Natural Sugar, exuded from the butt of a fallen sugar pine (*P. Lambertiana*) from West Point, Calaveras County; presented by Ira H. Reed. Quartz crystal in Malachite, from Australia; by Rev. Albert Williams. Frontal portion of Skull, with horns, of *Bos* (*latifrons?*), from Alaska; presented by the Alaska Commercial Company. Minerals and Fossils, from Colorado Territory; by F. W. Van Reynegom. Fossil cast, from near Searsville, San Mateo County; presented by A. G. Walton. Portion of Tusk of a species of *Elephas*, from Lat. 69 deg. 22 min.; Head of male Walrus (with skin, for mounting); also, Skin of a small dark Seal; Skull of female Walrus; specimens of *Margarita*, and the opercula of *Natica*, and other mollusks, also, a Pebble taken from the stomach of a Walrus; Lice (small crustaceans) from Walrus; specimen of *Natica* (with Hermit Crab), and another crustacean; Parasites from Cod-fish caught in Ounimak Pass, Alaska; specimens of *Tunicates*, *Nereis*, and other marine forms, taken from stomach of Walrus; specimen of Coal from Point Belcher. All of the above collected and presented by Captain T. W. Williams. Specimens of Pods and Seeds of ("Monkey Pods") a leguminous plant; also, Pods of *Bombax pentandrum*, the cotton tree of India, from Sandwich Islands; numerous specimens of Seeds of eight species of plants; Bark of "Paper Mulberry," from which the native cloth *Kapa* is made; portions of the aerial roots, or descending stalks, of the Banyan Tree; small greenish Pebbles; specimens (fragments) of a species of Seaworm (*Nereidæ?*), called by the natives "Palolo," from the Navigator Islands; Oil, or Fat, from cocoa-nut eating Crab; also, specimen of (Amber?) Resin, thrown up by the sea, from the Caroline Islands; Gum (of a tree), called "Tutui"; also, Lacto-resin, and Inspissated Juice of a species of (*Artocarpus*) Bread-fruit Tree, from Hawaiian Islands. All the above collected and presented by W. R. Frink. Capsules and Seeds of a species of *Romneyia*, from Lower California; collected and presented by G. W. Dunn. Specimens of Minerals, from Cerro Gordo, Inyo County, California; from Carl Rabe. Minerals and Fossils (numerous specimens), from the Geysers and vicinity, Sonoma County; also, from Penitentia Creek, Santa Clara

County; presented by C. B. Turrill. Section of Baleen, from the Humpback Whale, Monterey, California, showing the arrangement of the plates of baleen. (This specimen, which is unique, was obtained by purchase.)

Mr. Stearns stated, in connection with the valuable contribution to the Academy's Museum made by Captain Williams, that last spring Professor Davidson solicited the Captain to make a collection in natural history for the Academy, and he cheerfully consented, and had brought us the interesting material which had been presented this evening; the male walrus head and the seal are preserved in salt, and are now stored at the Coast Survey office. Captain Williams reports the season as having been a very open one, and unfavorable for collecting, as he was unable to obtain a single whale, etc.

He went as high as latitude 72 deg. 15 min., and could have gone much further; and several of the whalers were as far east as Smith's Bay, in 153 degrees east, and could have gone even farther, had they not been afraid of the ice coming down and cutting off their retreat.

Mr. Frink stated in reference to the "gum" or resin of the Bread-fruit Tree, presented by him, that it is obtained by cutting through the bark, when a juice runs out, of the color, consistence and taste of ordinary milk; in the course of twenty-four hours it ferments, and the gum separates, like butter in the churning of cream; it can be obtained in large quantities on some of the islands of the Pacific; it is used by the natives to fill the seams of their canoes, and for plasters for cuts, sores, etc. For the latter use he had found it exceedingly valuable, and his opinion had been confirmed by the few surgeons to whom he had given samples for experiment. It is soluble in several fluids, and may yet come into extensive use for making fabrics water-proof.

The marine worm, "Palolo," which he had presented, is seen floating in early morning in certain channels near Savai and Upolo, Navigator Islands; it is seen (as it is stated) on only two days in the year; its return is calculated by the natives with astronomical precision; it appears in great abundance, and is caught only before sunrise, for as soon as the sun shines it disappears, to return only

at neap-tides in the month of October or November. It is esteemed by the natives a great delicacy; hence "Palolo" days are days of festivity, and thousands repair to the channels to gather it; it is of all colors, and the surface of the water at the time of its occurrence presents the most gorgeous hues. Last year the "Palolo" days were the 23d days of October and November.

Mr. Stearns remarked that the specimens were too imperfect to determine their true relations; the fragments appear to be portions of marine worms allied to the *Nereidæ*, and which resemble the terrestrial *myriapods*, of which the centipede was a common illustration.

Mr. Stearns, referring to the specimen of resin (amber?) from the Caroline Islands, which had been given to the Academy by Mr. Frink, said that the origin of Amber had caused a great deal of discussion; it is believed to be the fossilized resin of species of coniferous trees, allied to the pines; it must not be confounded with ambar or ambra, (*Ambarum griseum*) or ambergris, as the latter was of animal origin, being the product of the sperm whale, and found in its intestines; both *a-m-b-ĕ-r* and *a-m-b-ā-r* are sometimes found floating in the sea; the former on the coast of Samland, Prussia, and the latter in parts of the Pacific Ocean.

Notes on the High Sierra south of Mount Whitney.

BY W. A. GOODYEAR.

The following observations relating to the region south of Mount Whitney, and traversed by the Hockett Trail, between the Kern River and the eastern foot of the Sierra Nevada, were made during my trip with Mr. Belshaw into the mountains last July, when we climbed the supposed Mount Whitney, and discovered the mistake respecting it.

It is well known that at about the head waters of King's River, the summit of the Sierra Nevada forks into TWO GREAT RIDGES of nearly equal height and grandeur, which then extend far south-east toward Walker's Pass, though gradually diminishing in altitude after passing the summits of Mount Whitney and Kaweah Peak.

For a long distance the crests of these two ridges vary from ten to fifteen miles apart, and are separated from each other by the tremendous cañon of the Kern River, which lies between.

The culminating points of the eastern ridge are the Kearsarge Mountain, Mount Tyndall, Mount Williamson, Mount Whitney, the peak which has been

mistaken for Mount Whitney, and a few other unnamed peaks. Those of the western ridge are Mount King, Mount Gardner, Mount Brewer, Kaweah Peak, etc.

The Hockett Trail crosses the summit of the eastern ridge at an altitude of probably a little over 11,000 feet, at a point nearly opposite the centre of Owen's Lake, and a few miles south-east of the peak which has been mistaken for Mount Whitney.

We followed this trail to the locality known as Soda Springs, upon the main Kern River, which here flows at an altitude of between 6000 and 7000 feet above the sea.

Throughout this section of the country, the mountains, so far as seen, consist entirely of granitic rock, with the exception of a single, isolated and somewhat remarkable cluster of volcanic outbursts, at an altitude of about 9000 feet above the sea. This cluster consists of four crater cones of moderate size, resting on the granite, and one basaltic lava-flow of considerable magnitude. The first of these outbursts seen in following the trail from Lone Pine, is some five or six miles east of the Kern River, and its altitude is probably a little over 9000 feet. It forms the whole western half of a hill some 300 or 400 feet high, and reaches to its summit; while the whole eastern half of the same hill is naked, solid granite. This outbreak seems to be small and local, being apparently but a few hundred yards in extent in any direction; its length north and south, however, being considerably greater than its breadth east and west. Its situation on the hillside is peculiar. It appears as if a short fissure had opened here in a northerly and southerly direction along the western slope of this hill, pretty well up toward its summit, and just enough material been ejected through it to cover the whole western half of the hill, without, however, sufficient explosive force to scatter it much in any direction.

About a mile to the south of this hill are two twin crater cones, which I did not visit, standing close together, and nearly equal in height.

Following along the trail, we find at the distance of about a mile westerly from the first hill mentioned above another crater cone, some 400 or 500 feet in height, and perfect in form except that a breach has been made in its north-east side and deepened nearly to its base. From the immediate vicinity of the base of this cone a lava stream has issued and flowed for some four or five miles in a nearly true west course, following the valley of a pre-existing creek to the main Kern River, where it now ends in a bluff facing the river, but high above its bed.

Appearances indicate that in this case the lava stream issued first, and that after it had ceased to flow, the cinder cone was piled up over it at the point of ejection, the completion of the cone finishing the eruption.

The valley followed by the flow was rather broad, and the quantity of lava was large, filling the bottom of the valley, spreading out in places to half or three quarters of a mile in breadth, and varying in depth from a few feet to two or three hundred feet at different points. The valley had a rapid fall toward the Kern River, and the bluff, which now forms the end of the flow, is 1500 feet or more below the point of issue.

This eruption is of very recent geological age, far subsequent in date to the great volcanic period which covered the northern Sierra with such vast quantities of eruptive matter; for, throughout the central counties of the State, this period was substantially closed before the excavation of the modern cañons began; while this eruption occurred very late in the history of the formation of these cañons. Yet, if we could determine the years that have passed, we should find it old enough as compared with the life of a man; for since it happened, the little stream whose bed it followed has not only cut through it here and there, but near its mouth has eaten its way two or three hundred feet deeper than before into the solid granite under it. How far down the cañon of the Kern River itself the flow may have originally extended it is impossible to tell; for the river, in deepening its own cañon, has here swept it all away.

For a considerable portion of the way where the bottom of the lava is now exposed, it rests upon heavy masses of calcareous tufa, previously deposited by mineral springs; and I noted, as an interesting fact which I do not pretend to explain, that at a point where I examined the tufa, in immediate contact with the overlying solid lava, I could detect no physical change in it, such as might have been expected from the heat to which it must have been exposed; but it appeared just like the same tufa in other places where the lava had not touched it. Neither shall I attempt to answer the puzzling question, *why* this little cluster of volcanic outbreaks should occur away up here, in the heart of the solid granite range, 9000 feet above the sea, and with nothing else volcanic, so far as I know, within less than thirty or forty miles of it in any direction. I only note the fact.

Another point of some interest is the fact that, though I hunted for them, I found no glacial scratches, nor any other evidence of the former existence of glaciers anywhere in this portion of the mountains; not even on the peak which has been mistaken for Mount Whitney, and which is over 14,000 feet high; nor on the top or sides of another peak which I climbed in the *western* summit, four or five miles northwest of Soda Springs, and which cannot be much less than 12,000 feet high; nor in the cañon of the Kern River—which I followed for four or five miles—nor anywhere I went, did I find any traces of glaciers. This is certainly somewhat remarkable, when we consider the fact that the mountains only twenty miles to the north, though no higher than some of these, are, according to all accounts, full of glacial markings. It is true that much of the granite in the region where I traveled is comparatively soft, and disintegrates rapidly from weathering; but this is by no means the case with all of it, and much of it is as hard, and as well adapted to preserve such markings, as any in the Sierra. The fact, therefore, of their general if not total absence from this region certainly means something. It does not, of course, prove that glaciers have never existed here, nor that they may not have existed here for a very long time; but it does argue that if they have, then, owing to some cause not yet explained, they disappeared from this region long before they did from the mountains a few miles further north.

The general character and appearance of that noblest portion of the Sierra,

a few miles to the north of the peaks I climbed, have been already described in the Geological Survey Report and elsewhere; but no words can convey an adequate idea of its wild and majestic grandeur. It must be seen in order to be understood. I will only add, that its topography has never yet been worked up with anything like the accuracy of detail which is desirable for California's sublimest peaks, and it would be well if the Geological Survey had the means to send a party to spend a whole summer there, to do it.

In behalf of Mr. Edwards, who was absent, Mr. Stearns submitted the following:

Pacific Coast Lepidoptera.—No 3. Notes on some Zygœnidæ and Bombycidæ of Oregon and British Columbia; with descriptions of New Species.

BY HENRY EDWARDS.

I have brought together the following notes on species observed during a recent tour through Oregon, Washington Territory, and Vancouver Island, in the hope that they may prove interesting as regards the geographic range of the insects observed; while the new species described—which were collected during a somewhat hurried trip, and under many unfavorable circumstances—will serve to show the richness of the region traversed, and probably to call the attention of entomologists therein to a closer investigation of the many beautiful forms by which they are surrounded.

Fam. ZYGŒNIDÆ.

Alypia Sacramenti. Grote.

A fine specimen of this insect was taken by me at the Dalles, Oregon, in July, and another by Mr. G. R. Crotch at Lake Quesnelle, B. C., in August; so that it appears to have a far wider range than has hitherto been ascribed to it. I may add, that I again observed the habit cited by Mr. Stretch, in his "Bombycidæ of North America," of feigning death when captured. My present specimen had flown through an open door of a house in the town (no doubt attracted by some flowers in the window) and was found by me resting against the wall. Having no net with me, I placed a large pill-box under it, intending to shut it in; but, to my astonishment, before I could get the lid of the box above it, the insect fell backward into its prison, and lay as if dead until I reached my hotel, a distance of some three hundred yards. This habit is the more remarkable, as the other species of the genus are remarkably restless insects, taking flight at the smallest noise or other disturbing cause.

Alypia Ridingsii. Grote.

Four specimens taken near Cariboo, B. C., in May, by Mr. Crowley, who told me that it was quite common in that locality.

Alypia, sp.

In a small collection made by Mr. Crowley, in British Columbia, I noticed a very remarkable new species of *Alypia*, in which the hind wings were nearly wholly yellowish white, with very long fringes. The specimen was unset, and the case sealed up, so that I could not obtain access to it for the purpose of description.

Scepsis Matthewi, n. sp.

♂. Head dull black. Tongue chestnut brown. Palpi dull yellow, black at their tips. Antennæ bluish black, much longer than those of *S. fulvicollis*, with the pectinations larger and more distinct. Prothorax yellow, differing in tint in different individuals, and apparently fading with the age of the specimen. Thorax and patagia smoky drab, with a slight blackish tint in front. Abdomen bluish black above and below. Legs bluish black. Anterior wings perfectly opaque in fresh specimens, smoky drab, with a slight golden reflection. The costa is a very little paler, and the whole of the nervures are blackish, distinctly marked. Posterior wings, bluish black, with a broad longitudinal hyaline patch extending, in most specimens, through the whole extent of the wing, and even passing through the margin.

♀. Same as the ♂, but with the pectinations of the antennæ more simple, and the abdomen more robust.

Expanse of wings, 1.60 inch. Length of body, 0.55 inch.

Vancouver Island. August. Common.

The pale color of the upper wings, the length of the antennæ, and the more extended hyaline patch of the posterior wings, as well as the larger size of the entire insect, will serve to distinguish this species from *Scep. fulvicollis*.

It was taken in some abundance at Skinner's Bottom, near Victoria, by myself and my friend, Mr. Gervase Mathew, of H. M. S. *Repulse*, to whom I have great pleasure in dedicating it. Its habitat was the side of a lagoon overgrown with rushes. When disturbed, it flew slowly for a short distance, alighting again on the stems of the reeds, and was by no means difficult of capture. In this respect it differs exceedingly from *S. fulvicollis*, as that species, so far as my experience goes, has a rapid and continuous flight.

Fam. NYCTEOLIDÆ. H. S.

Sarrothripa Columbiana, n. sp.

Head dull white beneath, pale sea green above. Palpi dull white. Eyes brownish black. Antennæ brownish beneath, greenish white above. Feet wholly greenish white. Thorax pale sea green, with three black spots placed triangularly in front, and a large black blotch (in the center of which is a grayish green space) at the base. Prothorax velvety black, narrowly edged behind with sea green. Patagia sea green, blotched with white, with a double black line posteriorly. Abdomen smoky white, concolorous with the posterior wings.

Anterior wings pale sea green, indistinctly blotched with white toward the middle of the costa and the posterior margin. The velvety black markings, which give so beautiful an appearance to this insect, are very variable in their intensity; but the following may be regarded as their normal form. Central fascia much waved posteriorly, in its middle approaching the disc, and inclosing a clouded patch near the costa, which surrounds a deep black discal spot. Anteriorly, the central fascia is only slightly waved, very distinct on the outer edge, but shading to a black cloud on the inner margin. At the base of the wing are four more or less waved black lines, the two broad ones being most distinct, and the others broken up into irregular patches. Near the posterior margin is a notched line of black, which joins the central fascia on the interior margin, and on the posterior margin itself, is a row of nine minute angular patches, also velvety black. Fringe gray, mottled with sea green.

Posterior wings, smoky white, clouded toward the outer margin, which has occasionally some faint black lines at the base of the fringe. Fringe smoky white.

Expanse of wing, 1.10 inch. Length of body, 0.40 inch.

The ♀ is a little larger than the ♂, but is in every other respect quite similar.

Victoria, V. I., at rest on palings. August. Not rare.

I at first thought that this insect might be one of the numerous varieties of the European *S. Revayana*, but a comparison has convinced me that they are distinct. The present species may be known by its beautiful pale but rich sea green color, by the distribution of the markings of the thorax, and by the greater width and more rounded apices of the fore wings. It does not appear to be rare, though its habit of sitting in close proximity to lichens resembling it in color renders it liable to be overlooked.

Fam. LITHOSIDÆ. H. S.

Lithosia candida, n. sp.

Head and thorax silvery drab. Antennæ and palpi chestnut brown, whitish at base. Eyes large, black, with white reticulations. Abdomen silvery white, above and below. Feet smoky. Anterior wings clear silvery white, with a very faint yellowish tinge on the costa. Posteriors dull creamy white, slightly smoky toward their costal margins.

Under side, with the whole of the anterior wings and the costal margins of posteriors, smoky. Fringes white throughout.

Expanse of wings, 1.45 inch. Length of body, 0.55 inch.

This beautiful species was taken by me at a gas-lamp, in Victoria, V. I., in August. It is abundantly distinct from any North American species known to me.

Clemensia irrorata, n. sp.

Head, thorax, patagia, and abdomen, chalky white, with a few grayish brown hairs. Antennæ white, brownish at their tip. Palpi yellowish brown at base,

black at their tips. Anterior tarsi with blackish patches, remainder of feet and legs chalky white. Anterior wings cream white, covered over the entire surface with black irrorations. Along the costa are six well-defined sub-triangular patches, brownish black, almost equidistant, the basal one being the smallest. On the posterior margin are also seven equal brownish spots, the apical and middle one of which extend into the white fringe. At the base are two indistinctly waved lines of brownish black, two others near the middle extending from the costa to the median nerve, a brownish discal patch, and some irregular brownish blotches, toward the apex and posterior margin. On the first dorsal nerve are three small brownish spots. Posterior wings smoky white; fringes white, blotched with brown on the anterior angle.

Under side. Anterior wings smoky, darkest toward the costa, with some fawn-colored blotches toward the apex.

Posteriors smoky white, with a tuft of fawn-colored hairs on the anterior margin, and a small clouded discal spot. Margins of both wings with an interrupted black line.

Expanse of wings, 0.85 inch. Length of body, 0.25 inch.

Victoria, V. I.

Taken at rest on trunks of pine trees, by myself and Mr. G. R. Crotch, in August. This is now the third species known of this interesting genus. *Clemensia albata*, Pack, is somewhat common in the Atlantic States. *C. umbrata*, Pack. is known only through a unique specimen taken by myself at Congress Springs, Santa Clara County, which was, unfortunately, destroyed in its passage through the post from Dr. Packard's hands to mine. Luckily, however, an excellent drawing of it was obtained by Mr. R. H. Stretch, which has appeared in his "Bombycidæ of North America," and will serve to keep the species in remembrance until its capture can be again recorded. Our Coast will probably furnish other species, which may be sought for in pine woods, sitting on the trunks of trees during the day.

Fam. ARCTIIDÆ. H. Sch.

Epicallia virginalis. Bdv.

Apparently abundant in Oregon and Vancouver Island. I saw many specimens in the collections of Mr. Cox and Mr. Harvey, of Victoria, and took a few fine specimens in Portland, Oregon, in July, when it flew in some numbers about the streets of the city.

Epicallia guttata. G. and R.

This form, which, according to the observations of Mr. Stretch and myself, can only be regarded as an extreme variety of *E. virginalis*, was taken by me in both the above localities, equally common with the typical form, and manifesting precisely the same habits.

Leptarctia. Stretch.

I saw three distinct varieties of this genus in the small collection of Mr

Harvey, of Victoria; but I am unable to say to what species they belong, as I could not obtain them for comparison.

Arctia Americana. Harr.

During my stay in Victoria, I took four specimens of this beautiful insect, and examined five others, all of which were distinguished by the white margins of the prothorax and patagia, and by the absence of black spots on the sides of the abdomen.

Arctia achaia. Bdv.

Rather common in Portland, Oregon; coming freely to light, and not unfrequently found at rest on walls and palings.

Arctia, sp.

A very beautiful species of this genus—in which the male has stone-colored markings to the hind wings, like *A. Quenselii,* and the female bright orange patches—is not uncommon in May, in Victoria; but I could not obtain a specimen for description.

Other *Arctias* will probably be found in the regions treated of; one exquisite species recently described by Mr. Stretch as *A. superba,* having been taken at Esquimalt, V. I., by Dr. Bremner, of H. M. S. *Zealous,* and by him kindly presented to me.

Leucartia acræa. Pack.

Seven specimens taken at gas-lamps, in July, at the Dalles, Oregon.

Pyrrharctia Isabella. Pack.

A fine ♂, in no respect differing from my specimens from the Atlantic States, taken at Portland, Oregon, in July.

Spilosoma virginica. Walk.

Eleven specimens, at Portland, Oregon, in July, presenting very slight variations among themselves in the number and size of the black spots.

Hyphantria textor. Harr.

Two ♀ taken on the wing at Portland, Oregon, in July.

Halesidota Agassizii. Pack.

I found two specimens of the larva feeding, as usual, upon willows; and saw in a small collection, in Victoria, two examples of the perfect insect.

Halesidota argentata. Pack.

Two fine ♂ of this beautiful species were taken in the streets of Victoria during my stay.

Antarctia punctata. Pack.

Not rare in Oregon. I saw several specimens, of as many varieties, in a small collection belonging to Mr. O. Johnson, of Portland.

Phragmatobia, sp.

A specimen in the collection of Mr. Cox, of Victoria, certainly in no respects different from the European *P. fuliginosa.*

Fam. EPIALIDÆ. H. Sch.

Epialus modestus. Hy. Edw.

A specimen taken by Mr. G. R. Crotch, near Gold Stream, V. I., and by him kindly added to my collection.

Fam. LIPARIDÆ. Bdv.

Orgyia badia, n. sp.

Egg. Ovate, flattened at the upper end, chalky white, with dark spot at the apex; attached in large masses, and surrounded by the hairs from the body of the mother.

Larva. ♂. Deep velvety black, with a double dorsal yellowish stripe on the three posterior segments. From the head spring two black plumose series of hairs, and one of the same description form the posterior segment. On the dorsal region are four shorter plumes of hairs, dark buff, shaded with brown, and behind these are two naked scarlet tubercles. The rest of the body is covered with long yellow spines on the sides of the dorsal plumes, springing from scarlet tubercles, and near the lateral region are four yellow tubercles, below which is a slightly waved interrupted stripe of bright yellow. Head black, shining. Under side smoky. Feet and prolegs yellow.

. Same as the ♂, but larger, and with the plumose tufts much shorter.

Food plant, *Rubus* of various species. Fully fed in the early part of August, spun their web from the 4th to 11th, and the perfect insects emerged from the 18th to 30th.

Imago. ♂. Head, thorax, palpi, and antennæ chestnut brown. Abdomen with a blackish tinge. Feet and legs fawn color, the anterior tarsi banded with brown.

Anterior wings rich deep chestnut, with a rather broad band of pale yellowish brown crossing them near the middle, attaining its greatest width anteriorly. Near the posterior angle is a well defined clear white spot. Fringes dark brown. Posterior wings rich chestnut, a little paler towards the base. Fringes bright chestnut. Under side entirely rich chestnut brown, with a darker blotch toward the anterior margins.

Expanse of wings, 1.30 inch. Length of body, 0.50 inch.

♀. Entirely light drab. Wings rudimentary. Tarsi pitchy.

Length of body, 0.60 inch.

Victoria, V. I. Quite common about the streets of the city, where it appears to take the place of *O. antiqua* of Europe.

Fam. BOMBYCIDÆ. Bdv.

Clisiocampa. Curtis.

I obtained four species of this genus; three from Oregon, and one from Vancouver Island, all of which appear to me to differ from our California species. A monograph of the group is much needed.

Fam. SATURNIDÆ. Bdv.

Telea polyphemus. Hbn.

Apparently not rare in Vancouver Island. I detected some seven or eight specimens in the small collections of Messrs. Cox and Harvey. This insect, though one of our Pacific Coast varieties, has nevertheless a wide range. I have seen specimens from Victoria, northern and middle California, San Diego, Cape St. Lucas, and San Blas, Mexico.

Pseudohazis eglanterina. Bdv.

Rare in Vancouver Island, abundant on the main land near New Westminster, and not rare at Portland, Oregon.

Fam. DREPANULIDÆ. Bdv.

Drepana siculifer. Pack.

Two specimens, ♂, ♀, in all respects agreeing with the California form described under the above name by Dr. Packard, were taken by Mr. Crotch in Vancouver Island.

Fam. NOTODONTIDÆ.

Lacinia expultrix. Grote.

One specimen exactly agreeing with those sent me by Mr. Graef, and taken by that gentleman in New Jersey, was obtained by Mr. Crotch near Cariboo, B. C.

Fam. CYMATOPHORIDÆ. H. Sch.

Thyatira derasa. Brd.

Some time since, Dr. Behr gave me a specimen of this insect from Alaska, and I myself took a solitary example in the streets of Victoria. Our specimens are rather smaller than those in my cabinet from Europe, and have a more rosy tint on the upper wings; but the difference is not sufficient even to hint at the existence of a second species.

Cymatophora improvisa, n. sp.

Head gray with a rosy tinge, palpi short, dark brown, black at their tips. Antennæ light chestnut brown, whitish above. Tibiæ and tarsi light brown,

banded with black, with a rosy hue at their base. Thorax and prothorax velvety black. Patagia gray. Abdomen olive gray above and below, tip rosy.

Anterior wings rich olive brown, with a yellowish-green blotch at the base, and an oblong one at the apex, which latter rests on a narrow waved line of the same color running to the interior margin. Central fascia smoky gray, broadest toward the costa, and much notched anteriorly, the brown spaces on each side being traversed by several indistinct waved black lines. On the costa toward the apex are some minute rosy streaks directed toward the center of the wing. Posterior margins with a row of velvety black, lunate marks. Fringes rosy gray. Posterior wings very glossy, with a rosy hue, and a row of indistinct lunate black marks along the margin. Fringes rosy gray. Under side dull smoky gray, darker toward the margins, with a waved brown line across the middle of the lower wings.

Expanse of wings, 1.60 inch. Length of body, 0.65 inch.

From chrysalis found under a log at Cascades, W. T., in July. The moth emerged in September. The chrysalis was a bright chestnut brown, enclosed in a thin web, with which a large number of particles of sand had been incorporated.

LIST OF NEW SPECIES.

Scepsis Mathewi,	Vancouver Island.
Sarrothripa columbiana,	Vancouver Island.
Lithosia candida,	Vancouver Island.
Clemensia irrorata,	Vancouver Island.
Orgyia badia,	Vancouver Island.
Cymatophora improvisa,	Washington Territory.

Mr. Dameron made a few remarks on Fish culture, and the ova and young of Salmon.

The Secretary read the minutes of the meeting of the Trustees relating to their action in accepting the deed of James Lick (of date October 3d, 1873), which deed was read in full at said meeting; the Secretary then read to the Academy the following deed:

This Indenture, made and entered into this, the third day of October, A. D., one thousand eight hundred and seventy-three, between James Lick, of the County of Santa Clara, State of California, party of the first part, and the "California Academy of Sciences," a corporation formed and existing under the laws of the State of California, and having its principal place of business at the City and County of San Francisco, the party of the second part.

Witnesseth: Whereas, said party of the first part, heretofore executed and delivered to the party of the second part, a certain deed, dated on the fifteenth day of February, A. D., 1873, which said deed was duly recorded in the office of the County Recorder, of the City and County of San Francisco, on the

twentieth day of February, A. D., 1873, in Liber six hundred and ninety-six of deeds, on page three hundred and sixty-four, which said deed conveyed the following described piece or parcel of land, situated in said City and County of San Francisco, State aforesaid, circumscribed by a line commencing at a point on the southeasterly line of Market Street, distant one hundred and ninety-five feet southwestward from the southwesterly corner of Market and Fourth Streets, and running thence southeasterly, and parallel with said Fourth Street, one hundred and ninety-five feet; thence southwesterly, at an angle of forty-five degrees, to a point two hundred and seventy-five feet from said southeasterly line of Market Street, which last mentioned point constitutes the southwesterly corner of the hundred-vara lot hereinafter mentioned: thence northwesterly, and parallel with said Fourth Street, two hundred and seventy-five feet to said southeasterly line of Market Street; thence northeasterly, and along said last mentioned line of Market Street, eighty feet to the point of commencement, said parcel of land being a portion of that certain lot of land laid down, and commonly known upon the official map of said City of San Francisco, as hundred-vara lot number one hundred and twenty-six.

Now, therefore, in consideration of the premises, and of the respect and esteem said party of the first part has, and bears to the said party of the second part, and the desire of the said party of the first part to further promote the prosperity of the party of the second part, and for the benefit of the sciences in general, and in order to relieve the said party of the second part from all the terms, provisos and conditions contained in the said deed, and of all disabilities, if any exist: Hath granted, given and conveyed and confirmed, and by these presents, doth give, grant and convey and confirm unto the said party of the second part, all the lands and premises described in said deed, hereinbefore mentioned, reserving and excepting out of said granted premises, all buildings, tenements and improvements of any of the tenants of the said party of the first part, that now are, or may be situated thereon, at the time when said party of the second part shall be entitled to the possession of said premises, and excepting and reserving from this grant and conveyance, the right to possess, use and occupy said premises, until such time as the party of the second part shall become entitled to the possession thereof, as hereinafter provided for, which right of possession, as aforesaid, said party of the first part hereby reserves unto himself, his heirs and assigns.

To have and to hold, all and singular, the premises hereby given, granted and conveyed unto said party of the second part and its successors, upon the following terms and conditions, subsequent nevertheless, which terms and conditions subsequent shall be binding and obligatory upon said party of the second part and its successors, that is to say:

First—That said premises shall never be encumbered by said party of the second part, or its successors, and shall never be allowed or suffered by said party of the second part, or its successors, to be sold for any taxes, assessments, or other charges levied or placed, or suffered to be levied or placed, thereon by the said party of the second part.

Second—That said premises shall not be alienated by the said party of the second part, or its successors, during the lifetime of any of the existing members of the said party of the second part.

Third—That said party of the second part, or its successors, shall never lease said premises, or any part thereof, or any edifice or part of any edifice erected, or to be erected, thereon; and said party of the second shall never permit or suffer any person to possess, use, or occupy the whole or any part of said premises, or any edifice, or any part of any edifice erected, or to be erected thereon, for any religious or political purpose, nor save for the proper purposes of said society, and for which it was organized, and has been heretofore conducted, but nothing herein contained shall be so construed as to prevent the said party of the second part from letting, temporarily, any hall or room in such edifice, for literary or scientific lectures, or as a depository for the exhibition of paintings, sculpture, and other works of art.

Fourth—That said party of the second part shall, within a reasonable time from the execution and delivery hereof, erect and forever maintain upon said premises an edifice of the description hereinafter mentioned, which shall cover all of said premises, except that portion thereof hereinafter described, which shall be devoted to the purposes of furnishing light and ventilation to said edifice.

Fifth—That said party of the second part shall erect upon said premises, except that portion thereof hereinafter described, a substantial and elegant brick edifice, three stories in height, with a substantial marble or free stone front, faced with designs and emblems appropriate to and for an edifice devoted to the use and for the benefit of Science. The structure and design of the edifice shall be classic, and such as will readily distinguish it from buildings used for business or commercial purposes. The style of architecture of said edifice shall be chaste and appropriate, and the same style and order of architecture shall be preserved throughout in its purity and with regularity.

Sixth—That at least one apartment of said edifice shall be constructed suitably for, and devoted to the purposes of a Library, and another apartment thereof shall be constructed suitably for, and devoted to the purposes of a Museum, and a third apartment thereof shall be suitably constructed for, and devoted to the purposes of a Hall of Lectures.

Seventh—That the following portion of said premises shall never be built upon, but shall forever be kept for the purposes of affording light and ventilation to said edifice, that is to say, all that portion of said parcel of land in said deed hereinbefore mentioned, particularly described, circumscribed by a line commencing at the most southwesterly corner of said hundred-vara lot, numbered one hundred and twenty-six; thence running northeasterly, and parallel to said Market Street fifty feet; thence northwesterly and parallel with said Fourth Street fifty feet; and thence running at an angle of forty-five degrees southwesterly to the point of commencement.

Eighth—That said premises shall be used and devoted (subject to the right of lease hereinbefore mentioned), solely and exclusively for the purposes of the incorporation of the party of the second part, and for none other. That said

edifice hereinbefore mentioned shall be commenced and completed as soon as practicable after the necessary funds for the erection thereof shall be furnished to, or obtained by, the said party of the second part; and whenever said funds shall be so furnished or obtained, and the said party of the second part shall be ready to proceed with the erection of said edifice, it shall give written notice to the said party of the first part, or his executors, and at the expiration of thirty days after such written notice, the said party of the second part shall be entitled to the possession of said premises, and the right of possession of said premises, hereinbefore reserved to the party of the first part, his heirs or assigns, shall cease and determine; provided, however, the said party of the second part shall commence the erection of the said edifice within ten years from the date hereof; else these presents shall, as to said second party, be absolutely void.

Ninth—That if the said party of the second part, or its successors, shall violate or fail to fulfill any of the foregoing terms or conditions subsequent, then and immediately thereafter, the estate and all interest given and conveyed as aforesaid, shall cease and determine—in which event, the said party of the first part, does hereby give, grant and convey the said premises and appurtenances unto the State of California, party hereto of the third part, in consideration of the love, esteem and desire to promote the general good of the said party of the third part, by the said party of the first part, to have and to hold forever; expressing the hope, but not imposing the condition, that the law-making power will devote the same to such uses and purposes as will best promote the objects and designs indicated by the articles of association and incorporation of the party hereto of the second part, and this and the said deed hereinbefore described.

In witness whereof, the said party of the first part, has hereto set his hand and seal, the day and year first hereinbefore written.

Signed, sealed and delivered in presence of Samuel Hermann.

JAMES LICK. [SEAL.]

STATE OF CALIFORNIA,
CITY AND COUNTY OF SAN FRANCISCO, } *ss.*

On this third day of October, A. D. 1873, before me, Samuel Hermann, a Notary Public in and for the said city and county, duly commissioned and sworn, personally appeared James Lick, known to me to be the person whose name is subscribed to the within and foregoing instrument, and he, the said James Lick, duly acknowledged to me that he executed the same.

In witness whereof, I have hereunto set my hand and affixed my official seal the day and year in this certificate first above written.

[L. S.] SAM'L HERMANN,
Notary Public.

Endorsed—Recorded in the office of the County Recorder of the City and County of San Francisco, October 14th, 1873, at 45 mins. past 1, P. M., in Liber 718 of Deeds, page 387.

A. R. HYNES,
County Recorder.

Per RICHARD D. BLAUVELT, JR., Deputy.

On motion of Dr. George Hewston, the action of the Trustees and also the above deed was unanimously accepted and approved.

REGULAR MEETING, NOVEMBER 17TH, 1873.

President in the Chair.

Forty-two members present.

William Harney, T. H. Blythe, M. W. Belshaw, G. L. Murdock, M. D., Newton Booth, William Murray, Joseph Perkins, and W. H. Moor were elected resident members; L. L. Robinson, life member, and W. M. P. Martin, D. D., LL. D., and S. W. Williams, LL. D., both of Pekin, China, corresponding members.

Donations to Library: Horti Elthamensis Plantarum Rariorum, etc., in two volumes, large 4to, half-bound (1774); also, Florilegium Amplissimum, etc., by Emanuele Sweertio, Autore, etc., large 4to, hf. bd., published in 1612–14, two rare old works, presented by Thomas C. Lancey. Monographie der Scydmaeniden Central-und Südamerika's von Dr. L. W. Schaufuss, small 4to, muslin, Dresden, 1866, presented by S. A. L. Brannan. Cabinet-Photograph-Album, turkey-mor., a gift from A. Roman & Co.

Donations to Museum: Crustaceans from San Diego, by Henry Hemphill. Specimens of Scorpions from Panama, by S. A. L. Brannan. Sample of granulated Beet Sugar made by the Sacramento Beet Sugar Company, from Robert E. C. Stearns. Two photographs of Hieroglyphics from Easter Island, presented by

Thomas Croft. Echini shells, from Mrs. William Shelley. Specimen of Piano wire that has been used in deep sea soundings, from Commander George E. Belknap, U. S. N. Specimen of fossil Fish from Sidney Station, U. P. R. R., presented by Oliver Eldridge. Piece of Beeswax from the wreck of a Japanese junk on the California coast, south of the Columbia River, by James S. Lawson. Specimen of Coal found at Cook's Inlet, Alaska Territory, presented by Captain Fisher, of whaling bark *Alaska*. Head of a Fish found on beach at Neeah, W. T., from William J. Fisher. Boots of dressed sealskin, Eskimo, of Cape Prince of Wales; Moose skin Shirt, Indians of Upper Yukon; Bar of native Copper from Indians of the Upper Tananah R., Yukon district of Alaska, presented by Major J. H. Simpson, through D. J. Staples.

Professor Davidson exhibited the Photographs of Hieroglyphics sent to the Academy by Mr. Thomas Croft, of Papeete, Tahiti. They were accompanied by a letter stating that these photographs were taken from the two sides of a thin block of wood, sent from Easter Island, latitude 27° 08′ S., longitude 109° 17′ W., to the Roman Catholic Mission at Tahiti. Some years ago the priest at Easter Island sent to the Bishop at Papeete, as a curiosity, some cord made of human hair, wound around a flat piece of wood about three inches wide and eight inches long, but jagged at the end as if it had been broken. This bore marks of age, decay, and hard usage. After removing the hair cord, it was found to be completely covered with beautifully cut hieroglyphics, which, from their regularity in lines, were evidently intended for the purpose of a written language. Subsequently five other blocks were obtained, but with different legends thereon, and bearing evidence of different ages. The Bishop, Monseigneur F. T. Janssen, has ascertained that these characters have, until lately, been taught to a few favored persons, and the knowledge of them transmitted through the heathen priests and rulers to their successors. The last King of Easter Island who was familiar with their meaning was Maurata, seized with others, in 1863, by the Peruvian brig *Mercedes*, and carried to Callao, and sold into slavery.

It is easy to trace the manner in which the reading of these hieroglyphics is effected. Commence at the left and read along

one line, and then turn the block end for end, and commence the next line at the left, etc.—thus:

CALIFORNIA
ʎWƎᗡⱯƆⱯ
OF SCIENCES.

He said that he would write to Mr. Croft and the Bishop to obtain photographs of the other blocks, and endeavor to get one for the Academy; and also reminded the Academy of former communications from Easter Island in relation to the large statues, causeways, and other signs of a prehistoric civilization on this small island in the South Pacific, and quoted extracts from Jacob Roggewein's voyage there in 1721, where the statues are referred to, the large stature of the people, and the presence of white men as priests among them. He hoped that some of our citizens would furnish funds to have a thorough examination made of the prehistoric remains upón this island.

On Further Examinations of the Amaknak Cave, Captain's Bay, Unalashka.

BY W. H. DALL, U. S. COAST SURVEY.

I brought before the notice of the Academy, last winter, some facts in relation to the exploration of a cave containing prehistoric remains, situated on Amaknak Island, in Captain's Bay, Unalashka, Aleutian Islands.

Further examinations this year have developed still more interesting results. The removal of a bed of 18 or 20 inches of mould, chiefly decayed organic matter, which contained the human remains and implements described in my previous paper, revealed a bed of shingle similar to the beach shingle of the adjacent shore, and which we then supposed to be the natural bottom of the cave.

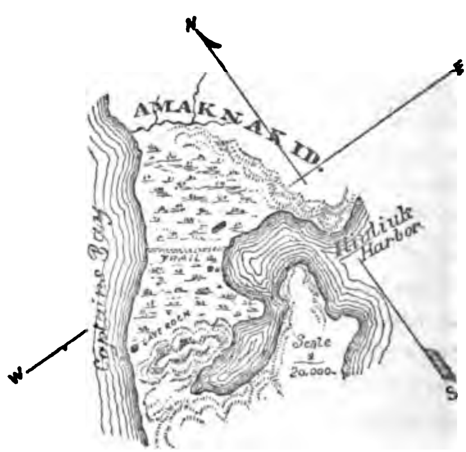

FIG. 1.—Reduced chart of the locality of the cave, showing the low isthmus between the higher portions of the island north and south.

This year, however, we ventured to remove a portion of this shingle, and to our surprise found a further deposit underneath it containing prehistoric remains. We then proceeded to clean out the cave to the bed-rock underneath, excavating the entrance sufficiently to admit the light of day upon our work. This afforded the additional information that the whole interior of the cave had been daubed or painted over with a red pigment or chalky ore of iron.

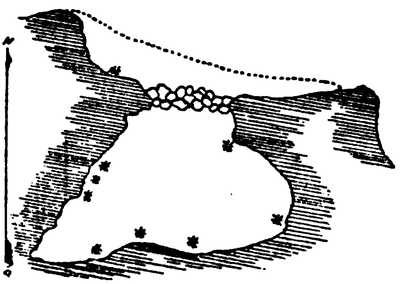

FIG. 2.—Horizontal section of the cave, showing the wall across the entrance. The asterisks show the positions of the skeletons in the upper stratum, and the dotted line the extent of the rock overhanging the entrance.

The upper stratum, removed the previous year, was from 18 to 25 inches in depth, and consisted of a fine brown mould, evidently resulting from the decay of animal and vegetable substances which had been deposited there. The remains found were scattered, or in groups on the surface, or covered by the mould. All the crania not decayed had been removed before we examined the cave in 1872. Below this was a stratum of shingle in beach-worn pebbles, weighing from a few ounces to several pounds, which had every appearance of having been deposited by water. The mouth of the cave is only a foot or two above the level of the highest part of the sea beach a few rods off, which is exclusively composed of similar shingle.

Below this we found a layer of six inches or less in thickness, of refuse material, the remains of repasts on marine animals, shell-fish, fish and echini. Scattered irregularly through this were broken and worn implements of quite a different character from those found with the dead. The cave is situated on an isthmus, across which from time immemorial has been a portage over which canoes were carried on the journey from one village to another; this cut-off saving a pull of several miles. From its dampness the cave could hardly have been used as a dwelling place, and the inference is that this deposit was the refuse of parties who, unable to launch their canoes into the heavy surf on the shingly beach, were obliged to camp in the vicinity and await calmer weather before continuing their journey.

Below this stratum was another bed of mould of organic origin, about two feet in its greatest depth, in the middle of the cave. Here, surrounded by a rough sarcophagus, built of the jaws and ribs of whales, we found three skeletons in a very fragile and almost decayed condition. Around these were found an abundance of implements, especially stone knives, similar to those found in the uppermost stratum, and described in my first paper. Then came the bed of the cave, a somewhat concave and irregular surface of soft porphyritic rock.

I believe these skeletons to be the oldest yet discovered in this region, though not approaching the Table Mountain or Neanderthal crania in antiquity. First the cave was used as a burial place for the three skeletons. Then over these two feet of mould accumulated by decay of animal matter and of rubbish, perhaps brought in by foxes for their nests, or rarely finding an entrance through the contracted aperture of the cave. This must have taken a long time. The great antipathy of these natives to approaching a burial place, not to say using it as a camping ground, leads to the belief that this use of the cave for interments must have passed out of the memory or tradition of the natives of the region before its occupation as a temporary camp could have commenced. Then the six inches of débris from the repasts of occasional visitors must have accumulated very slowly. It will be necessary to bear in mind that the cave is not open to the air in such a way as to admit the wind or rain, and the shingle of which the isthmus is composed is too porous to form a channel by which stuff might wash into the cave, even had its cavity been lower than the surrounding ground, which it is not.

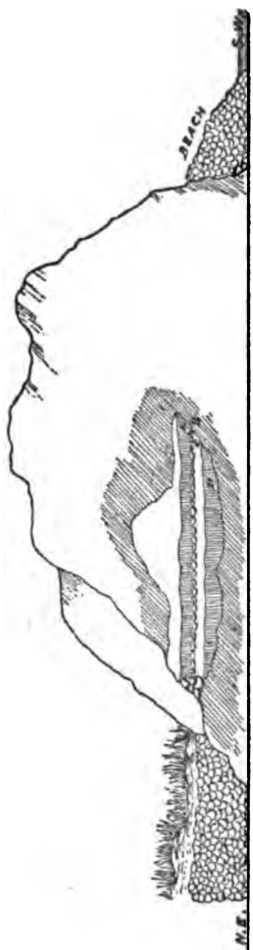

FIG. 3.—Vertical section of the Amaknak Cave, showing the rock, the beach southwest of it, and the flat isthmus formation northeast of it. A, upper stratum of brown mould. B, layer of shingle or beach-worn stones. C, stratum of "kitchen refuse," shells, etc. D, lower stratum of organic mould with skeletons.

Then it would seem as if some unusual storm, tidal or earthquake wave, was instrumental in forcing a layer of heavy shingle stones into the cave from the adjacent sea beach. After this had been accomplished, the use of the cave must again have been as a refuge for the dead, and the length of time this has been going on cannot have been small, from the number of remains of separate individuals discovered by us, and the great depth of the accumulated mould.

All the material found herein is of a date coëval with or antecedent to the earliest Russian navigators, nothing whatever bearing the impress of the more modern tools or methods introduced with the first rude efforts of civilization. About this time, to avoid the desecration of their burial place, or for some

other reason, the mouth of the cave was walled up. On the arrival of the Americans in the Territory, some one heard of a tradition connected with this singular and isolated rock, which rises like a tumulus from the level surface of the isthmus. A fox had forced a passage into the cave and used it as a lair. It was then opened, and a few crania and some implements which lay upon the surface were removed by curiosity hunters.

The natives, who still retain some of their old superstitious feeling about the burial places of their ancestors, are said to have secretly removed and buried the few remaining relics of humanity which were exposed to view. M. Pinart, the ethnologist, after a casual glance at the cave, satisfied himself that it contained nothing, and then informed me of the locality, and the results of my examination have been detailed in my previous and present papers.

In my first paper I remarked upon some other caves on the island of Unga, and figured some wood carvings from one of them. These caves had been well ransacked by curiosity hunters, including M. Pinart, who carried off the better preserved and more accessible crania and carvings before we had an opportunity of visiting it in 1872. A storm interfered with our operations on that occasion, and we were obliged to leave the cave with only a handful of the collections we had extracted from its recesses. On revisiting it this year we found everything as we had left it in 1872, and proceeded to clean it out thoroughly, as well as several others which we discovered near by. We succeeded in obtaining a rich harvest of carvings, fourteen well preserved crania, and various remains of mummies. These had been so injured by dampness as to afford only fragments and pieces of exquisitely woven grass matting, in which—and in otter and fox skins—they had originally been enveloped, and then suspended in cases similar to a hanging cradle.

We obtained in the Islands this year thirty-six strictly prehistoric crania, and one of later date, several hundred bone, ivory, and stone implements, at least three hundred carvings of wood, most of which had been gaily painted with mineral earths of red, blue, green, white, and black colors.

We obtained evidence of the existence of large and flourishing communities numbering thousands of inhabitants, where now none, or only small remnants of population exist.

Underneath the old villages were found still more ancient kitchen-heaps of echini, fishbones, and edible shell-fish, many feet in thickness; the age and time taken in forming them hardly to be approximated or counted even in centuries. It is only in the upper strata that we find the indications of progress in hunting and fishing, afterwards so notable that even the sperm whale succumbed to the attacks of these hardy canoe-men. Their progenitors were content to pick echini from the shore and mussels from the rocks, and hardly any implements could be found in the refuse of their repasts, the accumulation of centuries. After them large villages of solidly constructed houses rose; and probably at the height of their progress and numerical increase, the almost equally barbarous Russian of Siberia fell upon them, and almost swept them from the face of the earth. Even under Russian influences they continued to

advance until more than half civilized, and it has been reserved for Americans to deny them schools, laws, or protection, and to cast them on the tender mercies of unscrupulous traders.

On Nickeliferous Sand from Fraser River.

BY JAMES BLAKE, M. D.

This sand, which was obtained in the gold washings on Fraser River, has very much the appearance of small particles of iron pyrites, being of decidedly a yellowish color. Under the microscope it is found to consist of two distinct substances, one of which is evidently magnetic oxide of iron, or the common black sand of our gold deposits; the other is of a yellow color, in the form of small scales, without any well marked crystaline structure, and the edges of which have been rounded by abrasion. The whole of the sand is strongly magnetic, so that with the exception of a few scales of gold, it contains nothing that is not taken up by the magnet. An analysis of the sand shows that it contains nothing but the oxides of nickel and iron. 0.9153 grains of the sand yielded 0.256 sesquioxide of iron, and 0.6548 oxide of nickel, which would give, supposing the iron to be in the state of magnetic oxide 0.231 of oxide of iron, and if we suppose an analogous oxide of nickel to exist we should have 0.702 of the magnetic oxide of nickel.

Thus making 0.931 instead of 0.9153 the quantity used, the excess of 0.016 being undoubtedly due to the nickel, from the difficulty of freeing it completely from the potash with which it is precipitated.

Although I can find no mention of such a compound of nickel, either in Watts' Dictionary of Chemistry, or in Dana's Mineralogy, yet I have no doubt that the form in which the nickel exists in this sand is an oxide with the composition $Ni^3 O^4$, analogous to the magnetic oxide of iron, $Fe^3 O^4$, thus establishing another relation between the compounds of nickel and iron. From the large proportion of it in the sand, fully 75 per cent., it is strange that its presence has not been before noticed.

On the Spontaneous Combustion of Hydro-Carbon Vapors.

BY I. C. WOODS.

During the years 1870–1871, and a portion of 1872, at the wood preserving works of which I am the manager, we had several instances of the spontaneous combustion, accompanied by explosions, of hydro-carbon vapors; some of the particulars of these accidents, and a statement as to the remedy I successfully applied, may be interesting to the members of the Academy, and useful to the public.

The hydro-carbon vapors we use for the preservation of wood are obtained by the distillation of coal tar. A brick pit is attached to each two stills, to hold the hot pitch product as it runs from them. This pit has an opening on the side for access, and a ventilating chimney through which the vapors from

the pitch pass off into the atmosphere. The opening for access into the pit is closed by an iron door.

The tar we use is made at the gas works in this city. We use stills of 1,200 to 1,800 gallons capacity. In the progress of our work the still containing the coal tar is run until the thermometer on the top near the man-plate indicates a heat 420° Fahrenheit, when we cease firing. The still and contents are then allowed to stand and cool, until the same thermometer indicates a heat of 200° to 212° Fahrenheit. At this heat the liquid pitch is allowed to run from the still into the pitch pit. As it cools it becomes solid. From the time the thermometer in the still indicates a heat of 420° Fahrenheit, until and after the time of letting out the pitch, the cocks remain open in the vapor pipe connecting the still with the wood-preserving tank.

Until April, 1872, this letting out of the hot pitch was attended with danger of fire, because of the tendency of its vapors to spontaneous combustion. If running the still daily, such accidents would occur three or four times a year. The vapors from the pitch in the pit, as they passed out of the ventilating chimney, were yellow, being the vapors of the napthalin oil contained in the coal tar. The combustion would take place after the pitch had been running freely from the still for some minutes. It was always accompanied by an explosion, loud enough to be heard across the street, and powerful enough to force away the wooden braces placed against the iron door. Pieces of timbering in the pitch pit would take fire, and burn until extinguished.

From the time the fire is extinguished under the stills, to the time of letting out the pitch, there is always an interval of fourteen hours. The furnace of the still is always closed with an iron door, and clayed up. There is a strong draft up the chimney of the still.

The top of the ventilating chimney of the pitch pit is as high as that of the fire chimney to the still, and there is always a strong draft up this chimney through the cracks between the iron door and the brick work of the pitch pit. A person standing at the iron door would not smell any of the vapor of the pitch. The distance from the outlet of the pitch pipe of the still to the furnace door of the still, is not less than twenty-two feet. At the time of our last explosion, the furnace of the still had been carefully examined before the pitch was let out. No remains of fire were found there, nor was there any other fire in the building. The hour was 10 A. M., Sunday morning—the works not in operation.

This property of heated hydro-carbon vapors to spontaneously ignite after absorbing a certain quantity of atmospheric air, is not laid down in any work to which I have had access. A number of scientific gentlemen to whom I have mentioned the above facts, were as ignorant as myself of their having that property. The remedy I have devised, after experience, is simple and complete. It is the introduction of a small quantity of water into the pitch pit while the pitch is running from the still. The hot pitch vaporizes the water, the yellow vapor from the chimney is turned to white vapor, and the desired safety is obtained. Too much water must not be put into the pit at one time, or the pitch will boil over; not a dangerous but a troublesome result.

I had noticed that the hydro-carbon vapors would eat away, in holes, the seat and valve of composition globe valves; also, that whenever this took place, steam was liable to leak into the wood-preserving tank during the process of vaporizing the wood, and that whenever the steam did so leak, that the influence of the hydro-carbon vapors on the wood was destroyed. This led me to try with success the experiment of the effect of steam on the vapors of the pitch. Since April, 1872, when I first applied this remedy I have described, not a single explosion has occurred at our works. I apply the water through a half-inch iron pipe, connected with the Spring Valley mains, and regulated by a cock.

I have reason to believe that the vapors from a combination of coal tar and petroleum, are more liable to spontaneous combustion than the vapors from coal tar alone.

Mr. McChesney called the attention of the Academy to a conspicuous Indian mound existing near Oakland, about two and a half miles from Broadway Station, and about 300 feet from the water's edge. It was circular in form, about 175 feet in diameter, with sides sloping from 45 to 50 degrees; it is, so far as he had examined it, composed of shells and other debris, and was now covered with shrubbery. The upper surface was somewhat hollowed.

Mr. Dameron referred to certain mounds that he had examined near Alameda Point, and which contained stone implements, shells and bones.

The President stated that this is the condition of nearly all these mounds; but in many, skeletons are found in a sitting posture.

Mr. D. J. Staples said that he did not deem the little information he had to offer of much importance, unless the fact of witnessing burials in the winter of 1849–50 may aid in the solution of the question "Whether the bones found in these mounds are of prehistoric age?"

In the winter of 1849–50, on the Mokelumne River, fourteen miles northeast of Stockton, I witnessed the burial of several Indians, three of whom had died in one night from the effects of bad whisky. These were placed in the ground near the tents or houses occupied by the tribe, and buried in sitting position, surrounded by their personal property, consisting principally of beads, trinkets, etc., the graves being made in the depression of the rancheria where formerly stood a sweat-house. The following year I saw the same ceremony performed, on one occasion, at the same rancheria,

and another time at a place some miles farther up the river. In my opinion, the reason for the Indians burying their dead so near the habitations of the living, is found in their indolence and filthy habits, and in part, perhaps, to the desire to often visit the graves of the departed. A number of mounds which I have examined on the Upper Sacramento and American Rivers, appeared to have been partially thrown up with the earth; and I am of the opinion that the Indians designed them to raise their brush huts above the encroachments of the spring floods. I feel quite confident that scientific men will not discover anything in the Indian mounds of California to connect them with a prehistoric age.

The President said, that up north the Indians seldom bury their dead near their homes. They sometimes put them in trees, sometimes in canoes, and sometimes in the ground. In Sitka, however, the graves are all very near the homes of the living.

Mr. Ellis called attention to a large mound in the southern part of the city. He said perhaps the Indians, being too indolent, had buried their dead where it was easiest to dig. As to the hollow in the center, they perhaps threw up dust around the edges to protect themselves from the wind.

Mr. Dameron said that in early days in the Sacramento Valley, they burned their dead. Perhaps the mounds were built to keep them from the floods.

Regular Meeting, Monday, December 1st, 1873.

President in the Chair.

Forty-one members present.

Henry Kimball, W. N. Lockington, S. P. Carusi, J. R. Scupham, and E. J. Fraser, M. D., were elected resident members.

Dr. C. M. Hitchcock, resident member, having paid the required sum, became a life member.

Donations to Library: U. S. Naval and Astronomical Expedition, 2 vols., 4to., Washington, 1855, presented by Mrs. Mary Swift. Revision of the Echini by Alex. Agassiz, 2 vols., 8vo., Cambridge, Mass., 1872, presented by Prof. Louis Agassiz. Proc. Acad. Nat. Sciences of Philadelphia, pp. 205–360, March–Sept., 1873. Catalogue of the Mollusca of Rhode Island, pamph., 8vo., by Horace F. Carpenter, Jan., 1873, from the author. Cal. Horticulturist, Nov., 1873, from publishers. Fifth Annual Report, Peabody Acad. of Science, for 1872, Salem, Mass. Bulletin of Buffalo Society Natural Sciences, pp. 129–184, 1873. Proceedings Royal Geographical Society, Vol. XVII, Nos. III, IV, V, London, 1873. Report of the U. S. Commissioner of Education for 1872, pamph., 8vo., Washington, 1873. American Naturalist, Oct. and Nov., 1873. American Chemist, Sept., Oct., and Nov., 1873. Societie Entomologique de Belgique, No. 91, 1873. Trans. and Proc. of the New Zealand Institute, Vol. V, 1872, Wellington, 1873. Canadian Naturalist, Vol. VII, Nos. 2–3. Engineering and Mining Journal, Vol. XVI, No. 16–21. Mittheilungen der Deutschen Gesellschaft, Yokohama, July, 1873. Nature, Sept. 18–Nov. 6, 1873. Am. Jour. Science and Arts, Oct. and Nov., 1873. Monatsbericht der Konig, Preuss. Akad. der Wissenschaften zu Berlin, Mai, 1873.

Additions by purchase: Popular Science Monthly, Nov., Dec., 1873. Journal of Botany, London, Oct. and Nov., 1873. Annalen der Physik und Chemie, Bands VI and VII, Leipzig, 1873. Annals and Magazine of Nat. History, London, Oct. and Nov., 1873. Astronomical Register, London, Oct., Nov., 1873. Journal of the Microscopical Society of London, Vols. 1–8, 8vo., mor. hf. bd.

Donations to the Museum: War-costume or armor of Japanese Daimio and attendant, presented by F. Castle, through Dr. George Hewston. Two specimens of a large Pinna, from Espiritu Santo, Lower Cal., by Capt. William Metzgar. Specimen of Coal from the Chase River seam, Nanaimo, B. C., presented by Comdr. Geo. E. Belknap, U. S. N. Specimens of Ferns from Norway, presented by Mrs. Emeline M. North. Three photographs of the Moon, by S. W. Shaw. Specimen of Fishing-dress worn by natives of the Fiji Islands, presented by Henry Edwards.

Remarks on the Genus Lilium.

BY H. N. BOLANDER.

The genus Lilium is represented in the State of California by the following distinct species, and several well-marked varieties:

1. Lilium Washingtonianum, Kellogg.
2. Lilium Humboldtii, Roezl.
   L. Bloomerianum, Kellogg.

3. Lilium Canadense, Linn.
var. *L. parviflorum*, Hook.
var. *L. pardalinum*, Kellogg.
var. *L. Californicum*, Hort.
4. Lilium parvum, Kellogg.

§. Bulbs ovoid, outer scales largest, fleshy, imbricated, lanceolate.

1.' Lilium Washingtonianum, Kellogg,

Occurs on the Cuyumaca Mountains, in San Diego County, its most southern limit known at present; northward along the western slope of the Sierra Nevada, between 3,500 to 6,000 feet altitude; in Oregon to the Columbia River, and on the Coast Ranges north of San Francisco, especially in the eastern parts of Mendocino and Humboldt Counties. In all localities named, it occurs either on ridges or on lightly shaded slopes of ridges, having a porous loose soil, resting on a gravelly subsoil. At no time have I met with a plant of this species in a soil whose drainage was not perfect; and, when found on a slope, did not face towards some point between east and south. The pale, loosely-scaled, ovoid bulb is generally found at a depth of from twelve to twenty inches. The height of the stem, the number of whorls and flowers on a single stem, vary very much according to soil, exposition, and age of the bulb.

Much has been said about the difficulty of cultivating this beautiful species. I willingly confess that I have also met with many reverses, until I paid proper attention to its habits and habitats. If the bulb is planted at a depth of from eight to twelve inches in a loose, somewhat gravelly soil, having perfect drainage, there is no difficulty in obtaining satisfactory results. Although there is positively no specific difference between bulbs and plants, collected either on the Sierras or on the Coast Ranges, yet I found that bulbs from the Coast Ranges would always bloom more readily in San Francisco (in cool houses) than those from the Sierras. The reason is obvious; but it would be interesting to know if the same holds good at other places than San Francisco. The flowers are very fragrant, and change gradually from a pure white to various shades of purple or lilac; the purplish-red spots are rather minute. The figure given in Mons. Louis van Houtte's Flore (Vol. XIX.) is a very correct representation of this species.

2. Lilium Humboldtii, Roezl.

L. Bloomerianum, Kellogg.

This large species has apparently a far less wider range than the preceding. It occurs mainly on the more elevated portions of the foot-hills of the Sierras, from 2,500 to nearly 3,500 feet altitude, evidently requiring a greater amount of heat to develop its full size and beauty than the first-named species. The soils in which its bulb is found are of a rather compact nature, consisting of clay, with an admixture of broken rocks, and a small portion of vegetable mould. Growing in open park land or land entirely cleared off, and therefore exposed to a hot and burning sun, and surrounded by a dry and exsiccating air,

we find its bulb also at considerable depth. Its ovoid bulbs are very large and strongly built; its outer scales are largest, imbricated, lanceolate, tinged with purple, and very fleshy, well calculated to hold a large supply of moisture.

A short time ago, this species was also found by Mr. Harford, on the island of Santa Rosa, opposite Santa Barbara. As far as I know, it has not yet been found on any part of the Coast Ranges belonging to the main land. The plant found on Santa Rosa island differs but slightly from that on the foot-hills of the Sierras. Its leaves are of a brighter green, acuminate, and its whorls are denser and more regular, while the leaves of plants from the Sierras are rather spathulate, and terminating blunt with a point; their green is also of a less vivid color. The former is exposed to sea breezes and fogs; the latter, to a dry and exsiccating air.

It may be stated in connection with the above remarks, that bulbs from Santa Rosa Island do far better with us here than those from the Sierras. The reason is plain.

The figure in the Flore of Mons. Louis van Houtte (Vol. XIX.) represents the Santa Rosa Island form as truthfully as a representation can be made.*

§. Bulbs rhizomatous, with short fleshy scales.

3. Lilium Canadense, Linn.
 a. var. *L. parviflorum*, Hook.
 b. var. *L. pardalinum*, Kellogg.
 var. *L. puberulum*, Torr.
 c. var. *C. Californicum*, Hort.
 var. *L. Walkeri*, Wood.
 var. *L. Hartwegii*, Baker.

The above enumerated varieties of this species demonstrate the influence of soil, location, and climate more forcibly than any other species of our lilies, because it is more generally distributed, and has a wider range throughout the entire State. It is, therefore, not to be wondered at, that so many excellent botanists described different forms of this variable species under so many different names.

a. The form of *L. Canadense*, var. *parviflorum*, Hook, occurring largely in boggy soil west of the great redwood belt, and on the immediate coast, presents even there differences in size and form, well calculated to lead astray. Here, wherever exposed to the daily continuous westerly winds, it attains hardly two feet in height, bearing often but a single small flower, of a deep red color, with the sepals but slightly recurved towards the tip; but wherever sheltered, either by trees or shrubbery, it attains a height of from three to five feet, bearing numerous flowers of a less reddish tint, and arranging its leaves, at least a part of them, in whorls; while those of the exposed plant are all scattered, and few in number.

* In the "Notes on Lilies and their Culture," by Messrs. Teutschel & Co., I find this species wrongly enumerated as one of the Canadense lilies. Its root is ovoid, not rhizomatous; nor does it ascend as high as Devil's Gate. What Roezl found there, was one of the *Canadense* varieties, and not *M. Humboldtii.*

This form extends along the immediate coast from Vancouver's Island to Oregon and California. This long linear extension and range is common to many plants of the immediate western coast.

b. Proceeding, however, eastward along a stream into the interior to a point where the coast climate changes gradually into that of the inland-coast valleys, and where an abundance of sunshine and shelter is added to that of moisture, we find the beautiful and charming form described by Dr. Kellogg under the name of *L. pardalinum*. Here, in deep recesses, on the banks of streams—in such favorable localities—the plant attains a height of from six to nine feet. Here its rhizomatous bulb ramifies and multiplies rapidly, forming clusters several feet in diameter. Stems shoot up side by side, from every terminating point of the ramifying or radiating bulb, giving the plant a gregarious appearance. Perhaps nowhere in this State is this gregarious character so well and plainly exhibited as in Bear Valley, on the Sierras, at an altitude of 4,000 feet, where acres of a wet meadow are densely covered by this magnificent form. The whorls are here usually broken up, and the large leaves are indefinitely scattered all over the huge stems, which are variously branched, bearing numerous flowers, with strongly recurved perianths of a bright yellowish-red color, copiously spotted with purple spots on the face.

But if we proceed from the inland coast valleys farther eastward, and enter the large valleys of the interior, where the climate is hot and the air dry, we soon lose sight of this plant, even on the banks of streams. Crossing the valleys and ascending the foot-hills of the Sierras, to an altitude of from 2,500 to 4,000 feet, we meet it again, in all its glory, in wet localities.

Growing in wet, boggy soil, mostly subject to overflowing at some time during the year, its bulbs are imbedded but a few inches beneath the surface of the soil. At San Francisco it blooms readily in cool houses.

c. The next marked form *L. Californicum*, Hort, (*L. Walkeri*, Wood; *L. Hartwegii*, Baker; *L. puberulum*, Torr.), differs very strikingly from the preceding variety in the form and arrangement of its leaves, and in habitat. The leaves are usually arranged in dense and numerous whorls, only the uppermost are scattered, linear-lanceolate, acuminate, and of a *dull* green color; while those of the preceding form are mostly spathulate, or oblanceolate, and of a *bright* green color.

This form we find on moist slopes of the lower foot-hills of the Sierras as well as of those of the Coast Ranges, where the climate approaches more or less in character that of the interior valleys. In these thus characterized localities, the plant is neither copiously supplied with moisture by heavy dews or dense fogs, nor by an abundance from below.

4. Lilium parvum, Kellogg.

The specific name of this species refers solely to the small size of the flower; for, in every other respect, this plant attains as large a size as any other of our lilies, if not larger. It begins at an elevation in the Sierras where, to my knowledge, *Lilium pardalinum* ceases to grow, namely, at an altitude of 4,000

feet, and extends upwards to 8,000. It is found growing exclusively on the banks of mountain streams, or in shady swampy places, through which a constant stream of cold water runs. The leaves are mostly scattered over the entire stem, spathulate, or oblanceolate, and somewhat glaucous. The ramifications of the branches, and the number of flowers, depend upon the size to which the plant develops. The perianth is of an orange yellow, spotted with purple, and but slightly recurved at the tip. Its cultivation seems to offer more difficulties than any other of our species.

Botanists, either collecting or studying California plants, cannot bestow too much care upon their habitats; and can never possess of one and the same species too large a suit of specimens, collected at different localities. In a country like this, where there are, in fact, but two seasons, the wet and the dry, passing abruptly from one into the other, the proximity to or the distance from the foggy coast, the general physical and mechanical properties of the different soils, the elevation, the exposition (whether west and north, or east and south), and the distance from the rainless belt bordering this State in the south, or from the rainy belt approaching it in the north, must be carefully taken into consideration.

Omitting for the present any remarks on those parts of California situated south of latitude 35°, and those north of latitude 40°, there are distinguishable in Middle California the following ten well marked botanical regions or belts, from west to east: 1. The immediate sea-coast belt; 2. The redwood belt; 3. The hilly or mountainous park and chaparral belt; 4. The Sacramento and San Joaquin Valleys; 5. The lower foot-hills of the Sierra Nevada to 2,000 feet altitude; 6. The Middle Sierra belt, between 2,000 to 4,000 feet; 7. The higher Sierra belt; 8. The Alpine region; 9. The eastern slope; and 10. The eastern basin.

The characteristic plants of these various regions or belts, and their climates and their influence on plants, will be the subject discussed in the next article.

Regular Meeting, Monday, December 15th, 1873.

Vice-President in the Chair.

Forty-five members present.

On motion the regular business of the Academy was suspended, and the matter of an appropriate Memorial observance of the death of Professor Agassiz was considered.

It was voted that a committee be appointed to arrange for a special meeting of the Academy, to be called for the foregoing

purpose, and the following gentlemen were elected to serve as said committee: Prof. George Davidson, Robert E. C. Stearns, Prof. D. C. Gilman, James Blake, M.D., Prof. E. S. Carr, Prof. H. N. Bolander, S. C. Hastings, and subsequently Dr. Franz Steindachner and W. H. Dall were added to the Committee; and on motion of Dr. Stout, it was

"*Resolved*, That to facilitate the action of the Committee on the memorial to Professor Agassiz, the Board of Trustees be invited to co-operate with the said Committee, to fulfil the wish of the Academy."

The regular business being resumed, F. Hiller, M. D., P. C. Lander, Daniel Swett, John Muir, John Lewis, Jason Springer, Gen. B. S. Alexander, U. S. A., were elected resident members, and J. H. Stearns life member.

Donations to the Museum: Specimens of Fishes, *Ptychocheilus grandis*, Grd., *Siboma crassicauda*, Grd., *Catostomus occidentalis*, Ayres, *Pogenichthys inæquilobus*, Bd., Grd., all from the Sacramento River; also, *Metrogaster aggregatus*, A. Ag., and *Micrometrus minimus*, A. Ag., from San Francisco Bay. Specimens of Humming Birds, *Ornismya mesoleuca* ♂, *Chrysolampis moschita*, Gray, from Brazil, and *Lesbia amaryllis*, Rehb., ♂, Central America; all of the above presented by Dr. Franz Steindachner. Specimen of Coal, found at Katmay Bay, Alaska, from Samuel Sussman. Whale Lice, from Right whale, taken near Kodiak Island; presented by Capt. C. M. Scammon. Seeds of *Nicotiana quadrivalvis*, Gray, from A. W. Chase. Specimens of Plants from San Jose del Cabo, Lower California, presented by E. Gillespie, Esq., U. S. Consul.

Donations to the Library: Narrative of a Voyage to the N. W. Coast of America, in the years 1811–14, etc., by Gabriel Franchere; 12mo, New York, 1854. The Little Things of Nature, etc., by Leo Hartley Grindon; 12mo, Boston, 1866. Hysteria, etc., six Lectures by F. C. Skey, F. R. S.; 12mo, New York, 1867. Currents and Counter Currents in Medical Science, etc., by Oliver Wendell Holmes; 12mo, Boston, 1861. Bee-Keeper's Directory, etc., by J. S. Harbison; 12mo, San Francisco, 1861. Martyria, or Andersonville Prison, by Augustus C. Hamlin; 12mo, Boston, 1866. The Industrial Progress of New South Wales, etc.; 8vo, Sydney, 1871. History of the U. S. Sanitary Commission, etc., by Charles J. Stillé; 8vo, Phila., 1866. A Journey

to Ashango Land, etc., by Paul B. Du Chaillu; 8vo, New York, 1866. Smithsonian Reports, for the years 1866 and 1869. Savage Africa, etc., by W. Winwood Reade; 8vo, New York, 1864. Arctic Researches and Life among the Esquimaux, etc., in the years 1860–62, by Charles Francis Hall; 8vo, New York, 1865. Missionary Travels and Researches in South Africa, etc., by David Livingstone; 8vo, New York, 1858; all of the above presented by Benj. P. Avery. A set of the Pacific Railroad Reports was presented by Col. R. S. Williamson.

A special vote of thanks was tendered to Frederick Castle, Esq., for his valuable donation of two suits of Japanese Armor, presented at the last meeting through Dr. George Hewston.

The following paper was read by Dr. Blake:

On the Puebla Range of Mountains.*

BY JAMES BLAKE, M.D.

The Puebla range of mountains, situate in the northern part of Humboldt County, Nevada, extends in a direction nearly north and south for a distance of about sixteen miles. It is formed in the principal part of its extent by two ridges, separated by a valley, this valley again being divided into three smaller valleys by means of divides running between the two ridges. The waters from these smaller valleys escape by ravines cut through the eastern ridge, and after getting into Puebla Valley, run north to join the waters of Trout Creek. The eastern ridge is formed of metamorphic rocks, principally micaceous and talcose schists, with some metamorphic limestones. These have a dip of about 78° E., with a strike generally north 16° E. They appear to have been thrown up by an eruption of porphyry, which now forms the crest of the ridge. The western ridge has the shape of an arc, of which the eastern ridge forms the chord. It overlaps the eastern ridge both at its north and south ends, the two ridges being separated in the middle by about a mile. This western ridge is composed entirely of volcanic rocks, arranged in regular strata, with a dip of 20° to the west. They form perfectly conformable layers, and extend from its base to the summit of the ridge, a height of more than 1,200 feet, 6,000 feet above the level of the sea. The beds are composed of many varieties of volcanic rock, as can be seen by the specimens I have brought this evening. The rocks are arranged in strata of from 2 or 3 feet to probably 100 feet thick. As they are composed of materials of different degrees of hardness, some of the rocks weather much more easily than others, the harder strata being left, forming escarpments in some instances many feet in height. These harder strata could be traced projecting along the side of the mountain as far as the eye could reach, following its contour with perfect regularity. From the top of these escarpments the surface of the hill always falls off for some distance conformably to the dip of the beds. This volcanic ridge attained its greatest elevation opposite the main transverse ridge between

* See Plate X.

the two ranges. This ridge had evidently been formed by an eruption of trachyte, after the main volcanic beds had been elevated. Masses of green trachyte were found on its crest, and the older volcanic rocks were thrown up almost perpendicularly along its flanks. The main ridge here attained a height of 7,500 feet, falling off rapidly to the north and south. On crossing the summit, at about two miles from the south end of the ridge, and descending about a quarter of a mile on its western slope, strata were met with, evidently of aqueous origin. They were laying perfectly conformable on volcanic rocks, and were covered in by a layer of gray trachyte, also perfectly conformable with these aqueous beds. The beds were about 200 feet thick, consisting of strata of white and red argillaceous rocks, rolled conglomerate, and were all evidently formed from the debris of volcanic rocks, the conglomerate being made up principally of rolled pumice. The west slope of the range gradually descended to the valley on the west side without any apparent disturbance, the slope of the surface during the whole of the distance being about conformable to the strata.

As before stated, this volcanic ridge bends to the east at each end, overlapping the ends of the east range. At the north end, these erupted rocks extend about three-quarters of a mile beyond the metamorphic rocks, and are here composed principally of grey and red trachytes, the extreme north point, however, being formed by vesicular basalts. At the S. end of the range, the whole mass of the mountain appears to have been thrown to the east for a distance of five or six hundred yards. There the metamorphic and volcanic rocks are in contact for a distance of three-quarters of a mile, the porphyritic axis of the latter not reaching the surface. It is directly opposite and to the east of this great dislocation that the hot spring breaks out with a temperature of 165°, from which were obtained the interesting specimens of diatoms, a description of which I submitted to the Academy in 1871. To the south of this dislocated portion of the range is a deep ravine, and beyond this, and in a line with the axis of the metamorphic range, is a range of hills running south about three miles, and gradually disappearing by the dip of the strata to the south. These hills present an almost perpendicular escarpment to the east, forming a cliff about 900 feet high. The lower part of the cliff is covered up by a mass of talus, which itself is so steep and loose as to prevent investigation of the structure of the rocks, and extends to a height of 300 feet above the base of the cliff. The rocks, however, are evidently stratified, of aqueous origin, and composed of volcanic materials that would appear to have been cemented together by a siliceous cement, rendering them almost proof against the action of the elements. The strata were very numerous, as I counted six different strata in a distance of about ten feet. They were of different colors, white, red, yellow, and some of the more well-marked beds could be traced along the whole face of the cliff, getting lower towards the south. At one part there was evidence of a fault, the beds having been broken off, and the south end falling about fifteen feet. This was the only disturbance that showed itself in these beds. The cliff itself was evidently the result of a vast fault, by which the ground in

front of it sunk at least 900 or 1,000 feet. The cliff is terminated towards the south apparently by a dislocation analogous to that which pushed forward the end of the main Puebla Range, throwing the whole mass of the mountain to the east. At this point the height of the stratified beds was about 400 feet. By this dislocation a pass was formed, by which I was able to reach the upper portion of the beds; they were found covered by a layer of trachyte, and over this again were strata of basalt. The probable age of these erupted rocks is the early Miocene. The eastern range is probably Triassic, as are the other analagous ranges in this part of the country. It undoubtedly, at an earlier period, extended to join the Vicksburg Mountains to the south, and, as before stated, formed part of the eastern shore of a vast basin, in which the beds of melted rocks were poured out in eruption after eruption, until they had attained a thickness of at least 1,500 feet, and possibly even a greater thickness still, as in no place are the lowest of these erupted beds exposed; in fact, the mineralogical character of the lower beds would indicate, according to the generally received views of geologists, that these beds are but the upper strata of a far more extensive eruption. Probably during the latter part of the Miocene era, a suspension of volcanic activity occurred, the surface became cooled, and the depressed portions of these beds formed the basins of lakes, in which the detritus from the surrounding mountains accumulated until it had formed deposits of many hundred feet in thickness. After this the strata became displaced, as we now find them. This displacement was caused, I think, by a sinking to the west, by which the eastern edge of the beds were tilted up, and a fracture was produced along the line where they were in contact with the schists and porphyries of what now forms the eastern ridge. The valley between the two ridges was thus made, and a subsequent volcanic outburst, the axis of which was from east to west, threw up a ridge dividing the valley into two parts, and elevating that part of the volcanic range, under which it occurred, some 800 or 1,000 feet, without apparently disturbing the older range to the east. Subsequently, this valley has suffered considerable erosion, and at one time must have been filled by a vast glacier, which flowed out over the southern part of the eastern range, depositing a moraine 250 feet thick, which extends a mile and a half into the plain beyond the base of the mountain.

Such is a general outline of the more marked geological features of the Puebla Range, and I now shall proceed to offer a few remarks on the mineralogical character and chemical composition of the erupted rocks which constitute its western ridge.

As before stated, this ridge is composed of different beds of erupted rocks, which are perfectly conformable, and have evidently been ejected at different periods of what must be considered the same volcanic era. Their number it is difficult to state, as the softer of them, by their more rapid disintegration, have covered the side of the mountain for considerable space with fine ash-like powder, which, as it never rains in these regions, has no chance of being washed away, and can only be removed in the form of dust by the wind. It is only the harder and more resisting layers that are exposed, as from these

the decomposed rock is blown away as fast as it is formed. As well as I could judge, I think there must have been more than a hundred of these different eruptions. The beds vary much in thickness, some being not more than two or three feet thick, whilst other present escarpments fifty feet high. As will be seen from the specimens I have placed on the table, these rocks differ much in their appearance, although, for the reasons before stated, specimens of the harder rocks were mostly obtained. The specimens numbered from one to six (see woodcut) were collected in about a space of 400 yards, towards the foot of the mountain; from seven to eleven, about half way up; and from twelve to fifteen, within 100 yards of the summit. As will be seen, the rocks present many varieties, the greater number, however, resembling anamesite. The true basalts were not often found on the surface, as they were generally so decomposed that the position they occupied was only indicated by the surface being covered with bright red dust, containing a large quantity of zeolites. Interstratified with these basaltic rocks, we find beds of diabase and labrador porphyry, and towards the top we find vesicular trachyte and porphyritic obsidian. These beds seem to follow no regular order: for instance, between two beds of anamesite is a bed of diabase. The labrador porphyry is in contact with true basalt, and immediately above the vesicular trachyte, is a bed of anamesite, forming the crest of the ridge; below it, is a bed of porphyritic obsidian; then, apparently for some distance, a bed of true basalt, the surface being covered with red dust, mixed with a large quantity of zeolites; and cropping out below this, is another bed of anamesite. There is a general mineralogical resemblance between the different beds, with the exception of the true basalts and the trachytic rocks. The others are composed almost entirely of labrador and augite, in varying proportions, and contained under different forms in the different varieties of rocks, the labrador being sometimes in large twin crystals, and in other rocks forming a complete network of minute crystals, which so thoroughly pervade the rocks as to prevent any other form of crystal being made out, although the presence of augite is rendered almost certain by polarised light. In the labrador porphyry, the crystals of labrador are sometimes an inch long. The augite is sometimes in grains, but more frequently in crystalline plates; it is usually green or brown. Magnetic oxide of iron is present in most of the rocks, although not in any large quantity, except in the true basalts, and in some of the darker anamesites. Sanadine has been found in the trachytes and in the basalts. Olivine, as usual, is met with in the basalts, and in most of the rocks micro-crystals are met with in large quantities. In general, the rocks are so completely formed of crystalline elements, that vitreous matter exists in but small quantities; it is generally pellucid and colorless, but in some instances green. On account of the only specimens obtainable being generally so much weathered, the exact determination of their crystalline structure was difficult. The chemical composition of some of these rocks has been determined, and furnishes quantities of the different substances of which they are composed, which vary considerably in the different specimens; for instance, in the red

vesicular trachyte, the amount of silica is 56.2 per cent.; in the labrador porphyry, 49 per cent.; in the diabase, No. 6, 51 per cent.; in the green trachyte, 72 per cent.; in the black porphyritic obsidian, 63 per cent.; and in the anamesite, No. 4, 44 per cent.

It is evident from the above facts that the relative position of these different beds is not in accordance with the views advanced by Richthofen, in his memoir, which was published by the Academy in 1868. In this memoir it is stated that in massive eruptions, of which the Puebla volcanic range presents so striking an example, the basaltic rocks are always the last to be thrown up, so that they invariably form the upper beds in all such eruptions. Here, however, we find true basaltic beds, occupying positions below other erupted rocks, occurring between beds of porphyry and diabase, and even directly under beds of a trachytic character. There can be no doubt but that Richthofen's system of volcanic rocks is but an expression of facts, as presented by a large part of the massive eruptions whose geological history has been carefully investigated. That the system, however, does not apply to the Puebla range of mountains, is, I think, beyond a doubt; and I expect the geological formation of this range will be found repeated in the vast outflows of volcanic rocks that cover so large a portion of eastern Oregon, extending north beyond the Columbia River.*

The mineralogical character and chemical composition of these Puebla beds is so interesting, that I hope at some future time to bring before the Academy a more complete account of my investigations on this subject.

Professor Joseph Le Conte read the following:

On the Great Lava-Flood of the Northwest, and on the Structure and Age of the Cascade Mountains.

BY JOSEPH LE CONTE,
Professor of Geology in the University of California.

ABSTRACT.

I.—Lava-Flood of the Northwest.

The author stated, that in the summers of 1871 and 1873 he made a geological tour through portions of Oregon and Washington, the object of which was to study the lava-flood of this region, and especially the structure of the Cascade range. He attributes much of his success to the kind assistance of Rev. Mr. Condon, the geologist of Oregon.

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* From the highest point of the ridge, as far as could be seen, the country to the north and west presented the appearance of a purely volcanic country. Vast faults were visible to the west, and when near enough to be made out, presenting sections of horizontal strata analagous to those at the south end of Puebla range. To the northwest was a high range, presenting a steep escarpment to the southwest, the top forming a table land, with a gradual slope to the north. Still farther to the north is the high range of Stein's mountain, on the top of which, I am informed, a large table land is found.

He describes the lava-flood as probably the greatest in the world. Issuing from fissures in the Cascade and Blue Mountain ranges, it spread over nearly the whole of Oregon, Washington, and Idaho, and far into California on the south, Montana on the east, and British Columbia on the north. Its area is certainly 200,000 to 300,000 square miles. Its thickness in the axis of the Cascade Mountains, where it is cut through by the Columbia River, is more than 3,500 feet. The section shown by the Des Chutes River, fifty miles from the axis, is 2,000 to 3,000 feet. The average thickness over the whole Cascade region (100,000 square miles) is probably not less than 2,000 feet.

II.—Structure of the Cascade Mountains.

The Columbia River, on its way to the Pacific, cuts through the Cascade range almost to the sea level. Its magnificent cañon reveals the structure of this range for nearly 100 miles. Except 120 feet at the base and in the axis, the whole range consists of layers of lava, piled one on top of another to the thickness of about 3,700 feet. The lava is cut entirely through only in the axis of the range, and there only for two or three miles; at this place, therefore, is revealed the old ground surface upon which the lava was first outpoured.

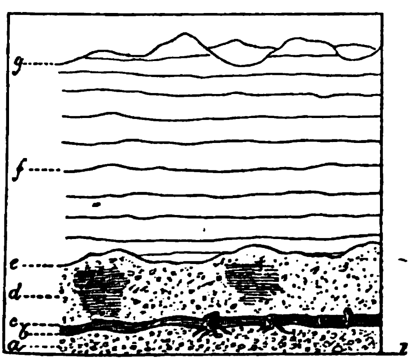

Fig. 1.

The river at this place (Cascades of the Columbia) washes against the southern cliff, and makes a fine section. The best place to examine is nearly opposite the lower steamboat-landing. The diagrams, figs. 1 and 2, represent the front view and a section of the cliff at this place.

From the water level to fifteen feet above, there is a coarse conglomerate (*a*) of porphyritic pebbles and boulders in a cemented earthy paste. This is limited above by an irregular dark line (*b*), a veritable ground-surface. On this stood silicified stumps, with roots ramified in the boulder soil beneath. Above this ground-surface lay a stratified sandstone (*c*), two feet thick, filled with leaf impressions. Above this lay a conglomerate (*d*), irregularly stratified in spots, like modified drift, containing scattered fragments of silicified drift-wood. Upon the uneven surface (*e*) of this rested lava layers, one above another, to the height at this point of about 3,000 feet.

That there might be no uncertainty about the actual relation of the lava to the conglomerate, several of the stream-beds running into the Columbia at this point—and making actual sections similar to the ideal section, fig. 2—were ascended. In several instances, in the stream-beds as well as on the Columbia River at Tooth Bridge, the actual contact of the lava with the underlying

conglomerate was seen. Undoubted evidence was also found that the upper surface of the conglomerate (*e*) was an old eroded land-surface, upon which the lava was outpoured.

There can be no doubt, therefore, that (*b*) marks the place of an old forest ground, upon which grew the trees, whose stumps still remain in a silicified condition, before the lava was outpoured; and that the leaves of the stratum (*c*) are those of these or contemporaneous trees. The order of events seems to have been: 1. A forest of oak and conifers. 2. The destruction of the trees by water, the shedding and burying of the leaves, and the rotting of the trunks to stumps. 3. The covering of the place several hundred feet with coarse deposit (*d*). 4. The erosion of this second land-surface (*e*) into hill and dale. 5. The outpouring of the lava, layer upon layer, for a long period of time. 6. Finally, the erosion of the streams—whether as ice or water, or both—through the 3,000 feet of lava into the underlying soil. It is this last fact, viz: the cutting through the lava into the softer underlying conglomerate, which determines the existence of the cascades of the main river, and also the perpendicular falls at the heads of the tributary stream gorges.

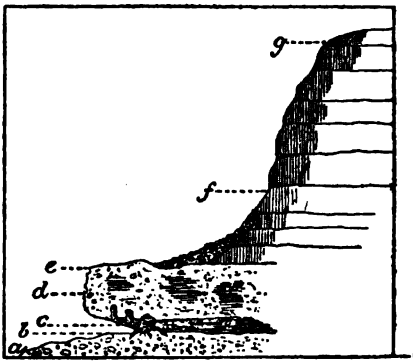

FIG. 2.

III.—Age of the Cascade Range.

There has been much doubt as to the age of the Cascade Mountains. The author thinks the leaf bed (*c*) furnishes the means of determining this question with considerable certainty. A number of specimens of leaf impressions and silicified wood, gathered by him, were sent to Prof. Lesquereux. According to this high authority, they are leaves and wood of species of oak and conifers, which indicate certainly Tertiary, most probably Miocene. The lava-flood, therefore, occurred during or after the Miocene. But since the upper surface of the conglomerate is an old eroded land-surface, requiring much time for its erosion, it is most probable that the lava flood occurred, or began to occur, *at the end of the Miocene*. This would make it *coincident with the formation of the Coast range*. It *began* to occur then; but it continued by the outpouring of successive layers, building higher and higher, probably, until the end of the Tertiary.

The height of the passes of the Cascade range is not more than 4,000 or 5,000 feet; but the lava is 3,000 to 4,000 feet thick. Evidently, then, the great bulk of this range is of late Tertiary origin. But the range probably existed before this as a low range of granite and slate, like the Sierras, and of the same age.

The evidence of this is seen in the granite and slate peaks, which still rise above the lava flood, along the skirts or thinner portions of the lava. This underlying portion, therefore, is of the same age as the Sierras; while the great bulk, *i. e.*, the lava portion, is probably of the same age as the Coast range.

IV.—Theory of the Ejection of the Lava Flood, and of the Formation of the Cascade Mountains.

Scattered over the surface of the Cascade lava-flood there are ten to twelve snow-clad volcanic peaks, and probably many other smaller cones. It is simply incredible that this immense mass of lava has issued from these craters—that the force of ejection has been only steam generated by the contact of percolating meteoric waters with incandescent fluid subterranean masses. The ejection of the lava-flood cannot be accounted for except by more general causes, affecting the whole earth—except by those great agencies by which mountain chains themselves are formed. It has been squeezed out through fissures by powerful lateral pressure produced by the internal contraction of the whole earth, as already described in a previous article.*

But there seems to be an inverse relation (recently pointed out by Dana †) between the amount of lateral mashing and folding of strata in mountains and the amount of fissure eruptions. I explain this as follows: Mountain ranges are formed by lateral crushing together and vertical upswelling of lines of thick sediments; but the ranges thus formed became afterwards subject to successive elevation by the action of the same force which first formed them. But there is this difference between the first formation and the subsequent increase: The yielding of the *softer sediments* is quite *gradual* and with little resistance, and therefore with little heat by transformation of mechanical energy (according to Mallet's pregnant idea), producing only *metamorphism, but not fusion* of the strata; while in the subsequent increase the yielding of the already *hardened land surface* is with *much resistance*, and therefore with much heat, even to the *fusion of strata*, and also paroxysmal with formation of great fissures, and the out-squeezing of the fused matter through the fissures as great sheets of lava. In the first process there is upswelling or *uplifting* of the stratified surface; in the second, an *upbuilding on* the stratified surface by the out-squeezing of liquid. In both cases increase of height is the same, being measured by the amount of lateral crushing,

Thus, to give examples: The Apalachian was formed by the first process—*i. e.*, by crushing together horizontally and upswelling vertically of thick sediments, at the end of the Coal period; its subsequent increase at the end of the Jurassic was with great fissure eruptions. The Sierras were formed by the first process, at the end of the Jurassic. A second elevation, with great fissure eruptions, took place at the end of the Tertiary. The Coast-chain was formed by the first method, at the end of the Miocene; while its great fissure ejections

* Am. Journal of Science, Vol. IV., p. 470. † Am. Journal of Science, Vol. VI.

took place at the end of the Tertiary, or later. So also with the Cascades. This range was first formed like the Sierras, and by the same method, at the end of the Jurassic; while its great subsequent increase, at the end of the Miocene, was by floods of ejected matter. In the first three cases the range was born, nearly full-grown, by the first method; while in the case of the Cascades the great bulk was produced by the second method.

The main point of this theory is equally tenable, whether we regard the sub-mountain liquid as locally formed by transformation of mechanical energy into heat, as maintained by Mallet, or whether we regard it as a remnant of the original sub-crust fire-sea of Dana.

V.—Some Points suggested by Previous Discussion.

The author then mentioned briefly several important subjects, which require additional observation.

a. The successive flows by which the Cascade Mountains are built up, are in many cases easily detected. In the section made by the Columbia River, the lava is arranged in layers, one above the other; ten or twelve may be counted, and many others are concealed by *débris*. In the Des Chutes River cañon at least thirty may be detected, and doubtless many others are concealed by *débris*. These layers sometimes evidently indicate separate flows; sometimes more doubtfully.

b. The sections made by the Columbia and Des Chutes rivers afford a splendid opportunity of testing the truth of Richthofen's view, that there is *an invariable order of succession in the appearance* at the surface, by fissure eruption, of *the different kinds of eruptive rocks*. The author made some observations which seemed to confirm, and others which seemed to oppose, Richthofen's view. He does not, however, consider his observations conclusive.

c. Formation of Columbia River cañon. The lava-flood was formed by fissure eruptions, which continued, probably, through the later Tertiary period, and then continued, in spots, by crater eruption almost till now. The erosion of the cañons took place subsequently to the lava flood. The Columbia River and Des Chutes River cañons, like nearly all our great cañons, were formed since the Tertiary. The author thinks that in the cañon of the Columbia the work of the post-Tertiary may be distinguished from the work of the present epoch. Fig. 3 is a diagramic section across the Columbia River cañon at the Cascades.

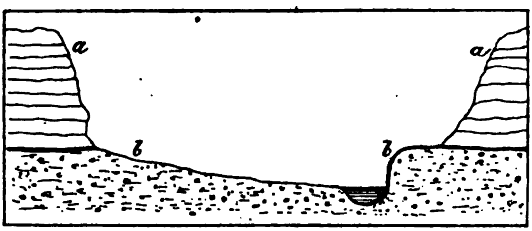

Fig. 3.

The wide part inclosed between the cliffs *a a* (which is about five miles wide) he thinks has been made during the post-Tertiary, either by ice or swollen waters, or both. During the present epoch the greatly shrunken river has cut its way into the underlying conglomerate, moving meanwhile steadily to the south, and making there a perpendicular cliff. If so, then the recession of the perpendicular falls of the tributaries back to their present position, about two or three miles from the main river, has also been the work of the present epoch.

VI.—Prairie Mounds.

Oregon and Washington are covered with a drift ten to thirty feet thick, composed of impalpable, unsorted earth (rock meal), mixed with pebbles and rounded boulders. The upper portion of this earth is finer, the pebbles becoming more numerous and larger as we pass downward. Thus it may be regarded as consisting of two parts—a finer and more movable layer above, and a coarser and less movable one below, graduating more or less perfectly into each other.

Again: At the southern extremity of Puget Sound, in the midst of the dense fir forests, and separated from them by the sharpest line of definition, there are remarkable narrow, irregularly ramifying glades, or prairies, entirely destitute of trees or shrubs. These are doubtless old bottoms of Puget Sound, made dry by elevation. They are covered with drift-soil. These grassy prairies are covered as thickly as possible with mounds, about three to four feet high, and thirty to forty feet diameter. There are probably millions of them. The general appearance is that of almost perfect regularity of size and shape. The soil of the mounds is a rather fine drift, with pebbles not larger than a pigeon's egg. The intervals between the mounds are strewed with larger pebbles. The mounds are occupied by ferns, the intervals only by grass. These treeless spaces are called "mound-prairies."

There has been much speculation as to the origin of these remarkable mounds. Some suppose them burial-mounds, and that we have here veritable *cities of the dead*; others, that they were raised as foundations for huts, on a wet soil; others, that they were made by a species of fish, when these spots were still the shallow bottom of the Sound—that they are huge fish-nests. No careful observer can for a moment entertain any of these views. The mounds have been frequently explored, and although from time to time there have been reports of relics having been found in them, the author feels quite confident that nothing has ever been found.

The author states that his observations in Eastern Oregon—where they occur in every variety of form, size, and regularity—and in California, convince him that they are the result of surface erosion under peculiar conditions; these conditions being a *bare country* and a *drift-soil more movable above* and less movable below. Erosion removes the finer top-soil, leaving it, however, in spots. The process once commenced, weeds, shrubs, and ferns take possession of these spots as the better soil, or sometimes as the drier soil, and hold them, and by their roots retard the erosion there. In some cases a departing vegetation—a vegetation gradually destroyed by an increasing dryness of climate—is an important condition.

Certain it is that in all the treeless regions of California and Oregon, that have not been touched by the plow, the same phenomenon may be observed, to a less extent. In California they are called "hog-wallows." The hog-wallows of California may be traced by insensible gradations into the larger mounds of Eastern Oregon, and these, in their turn, into the more perfect mounds of Mound Prairie; they are all evidently due to the same cause. If the mounds of Mound Prairie were a unique phenomenon, we might resort to exceptional causes; but a phenomenon so wide-spread must be due to a wide-spread agent.

Special Meeting, Monday, December 22d, 1873,

AT MERCANTILE LIBRARY HALL.

The President stated that at the last regular meeting of the Academy, this special meeting was called as a tribute to the memory of Professor Agassiz; and the programme, as arranged by the Committee, will consist of short addresses by its members, Professors Gilman and Joseph Le Conte, Rev. Drs. Stebbins and Scott, Mr. Stearns and myself.

Remarks of President George Davidson.

In his own handwriting, upon a souvenir of his Pacific Coast visit, is the legend "L. Agassiz, born May 28th, 1807." On the 14th of December, 1873, the telegraph flashed to the uttermost parts of the earth that he was no more; and we meet to-night to render homage to his memory.

After a few occasional meetings, from my first acquaintance with him twenty-seven years since, it happened to my lot last season to introduce him to the Academy and its friends, after his voyage of twenty thousand miles, undertaken at a time of life when most of us look forward for rest from life-toiling. You saw that his old enthusiasm was still ablaze; you felt the peculiar charm of his presence and voice, and were happier and better in knowing that you had come into personal relations with one who commanded such influence and power for good. So it has been through a busy, earnest life, devoted to but one object; to see him was to love him; to know him was to willingly promise service to science for all time, and to feel amply repaid in fulfilling that promise.

Learned men and statesmen, and educated, brilliant women, had hung on his words, and had paid the same tribute: all mourn with the same sorrow. In our

hearts he can never be forgotten; in the centuries hence, his influence and labors will assure students there were intellectual giants in these days.

To others, more intimate with his daily life and thoughts, must be left the analysis of that powerful hold which he maintained on all classes of men. Simplicity and purity of character, singleness of purpose, directness, and comprehensiveness of the highest order, were the bases for that subtle power which gathered facts from observation, combined and correlated them, thence deduced order; and placed them so lucidly and attractively before the learned and the unlearned.

With the permission of the Academy, I make this the occasion to say a few words upon the impetus, direction, and steadily preserved influence which he exerted upon scientific study in the United States; not only in his particular lines of investigation, but upon every other branch of knowledge. In 1846, fresh from contact with the advanced scientific men of Europe, and endowed with the amplest powers of body and mind, he saw and was delighted with the broad and untrammeled field in the country of his adoption. One rule he at once established for himself—that the results of all his investigations should be given to American, and not to foreign institutions; and to the day of his death he broke not the self-imposed obligation. He had cast his life and lot amongst us; and the communication of discoveries to others abroad—who, however, were no less his friends, admirers, and co-laborers—he deemed a special act of treason.

The many wants he discovered, upon assuming his professorship in Cambridge, would have disheartened and dismayed others less ardent and self-reliant. You recollect with what quaint and good humor he described the few dried fishes forming the collection of natural history, by which he was expected to illustrate his lectures and investigations. That want aroused in his mind the desire, and fixed the purpose, to found a museum of zoölogy which should surpass the most complete in Europe—not as a mere measure of vastness, but as the only proper means of affording the necessary material for the use of students, and for aiding the broader studies of the advanced naturalist. With constant thinking, the plan grew in scope and definiteness. Here men high in their special studies could thoroughly describe and classify every obtainable specimen, and designate their relation with each other; whilst the fossils of buried ages should reveal their story, and exhibit their correlation with the present epoch. From a critical discussion of such aggregated results, we may be assured that the law of development in the natural history of the world, whatever it may be, would be demonstrated.

He has not lived to see it. For a quarter of a century he has fought to obtain the means to perfect it, and has really succeeded as no other man upon this continent could have hoped for. But he has infused among our people the sentiment of more liberal assistance to science, and the full fruition of his labor will come to his successors.

It seems a marvel how much of the enthusiasm and industry of Agassiz has been developed among those who have studied or come in contact with him. I

there were any that became weary with the heat and burthen of the day, they have dropped by the way-side. The young, the earnest, the ambitious, are scattered over the globe, searching, working, and studying to increase our knowledge. The men of mark who have been students under him are not few; although, perhaps, differing from many of his views, they are working with his indomitable ardor. From him they have learned that their real student life but just commences when they quit the college halls for the broader and more suggestive fields where animal life exhibits itself in a thousand new relations, and suggests new methods and solutions.

In the last quarter of a century there has arisen in America a large body of the ablest naturalists, geologists, and palæontologists; and I attribute the thoroughness of their investigations, their enthusiasm and success, to the direct and reflected example of Agassiz.

But the impetus which he gave to the interesting study of natural history, to fossil icthyology, to geology, and especially to glacial action, had its effect upon all other branches of science. Remarkably well versed in every science, and intimate with the scientists in their specialties, he imparted to them, as the magnet to the steel, an equal amount of his force, directness, and thoroughness; he cheered the struggling, reinvigorated the diffident, and diffused a halo of attractiveness around each one's study.

He was especially earnest and forcible in expressing his views of scientific education. He contended for broader studies than those prescribed in the old, dogmatic curriculum; for something more than heavy, reiterated book-learning. He demanded original research, exhaustive observation, and rigorous comparison. And whilst garnering the treasures, he was peculiarly chary of propounding hypotheses and theories. To him the time had not come for laying down the law of development. He could not bear with superficial study: a man should give his whole life to the object he had undertaken to investigate. He felt that desultory, isolated, spasmodic working avails nothing, but curses with narrowness and mediocrity. Although strongly wedded to his particular objects and course, he fully realized and ably advocated the equal value and importance of the other special branches. He appreciated the fact that the tastes and peculiar mental fiber of others would lead them in other channels, and he looked forward to the time when their results should be brought into harmony with his own.

We hear so much of weak, inconsequent condemnation of specialists, that an erroneous but wide-spread misapprehension would appear to exist upon the subject. In every-day life, who hesitates to measure out commendation to the blacksmith, the printer, the farmer, the jeweler, the artist, the merchant, for excellence in their specialties? The steamship, the mansion, the bridge, are but the carefully combined results of men's labors in many special trades; and the strength and beauty of every structure and work are great and pleasing just in proportion as the special workmen are skilled. The moulding of all their results into one harmonious body is the work of another specialist, who has the comprehension to properly adjust and aggregate them.

The case is not at all dissimilar with the specialists of science. Each is gathering and logically arranging all the details of his examinations and study; whilst others are endeavoring to blend and harmonize, so far as practicable with yet incomplete observations, the results in the different branches of science. So delicate have become the means and methods of examination, so extreme the range of subjects, so intimate their correlation, that we are perforce compelled to confine our special investigations to single and very narrow lines of research. The geologist, botanist, chemist, physiologist, mathematician, subdivide their labors; cosmical physics attract one astronomer, observations of the planets another, spectrum analysis another. As the results in particular branches are announced, special discussions are entered upon to evolve the law which entwines and embraces them all. These discussions must conform to and be governed by mathematical processes. No indeterminate solutions can be admitted; for their presence indicates the necessity for more tangible facts.

It was the realization of this requirement for labor in specialties in natural history and its cognate branches, that impressed Agassiz with the necessity of a museum that should be complete in its absolutest sense; and to accomplish this he undertook his exploration on the Amazon, his voyage round Cape Horn, and had projected a voyage this coming May through the labyrinth of waters extending from Puget Sound to the Chilkaht River, in Alaska.

On the Pacific Coast we are full of faith that such a museum will be gathered by the Academy, and that, from the ample means of her benefactors, original researches in special branches of science will be systematically carried on, and the results be regularly made known in series of lectures. For general information, this method has had no abler exponent than Agassiz; in fact, he was the father of the method of popularizing science by lectures of the highest order by the investigators themselves. In the present flush of scientific lecturers we are too apt to forget that when he, many years since, commenced giving his series of lectures on natural history, fossil fishes, the glaciers, etc., freed from the usual flood of cold technicalities, he was looked upon as an innovator, and as degrading science. Fortunately, his conception of its value was the true one. A deep and abiding yearning for fresh, living information has been diffused, and, one by one, even the learned men of Europe have yielded to the pressure, and given of their abundant stores of knowledge to the humble as to the rich.

We cannot yet measure the full value of this new means of diffusing the results and methods of scientific investigations. It humanizes and expands the minds of men of power whose business, habits and pursuits have kept them apart from study since their school-boy days; it quickens the memory of the student and reader; and from the humbler walks of life it will call out the latent talent of many a gifted but timid youth, whose instincts and aspirations would have been chilled by the esoteric system of the old formal school.

In the introduction of this method of popularizing science, it was peculiarly fortunate that Agassiz had the rare power of stating so clearly and so logically, and of illustrating so rapidly and cleverly, the processes and deductions of his investigations. It was all new knowledge—not gleaned from encyclopedias or

composed of the unverified statements of others. It was mental food for the acutest thinker; it was comprehended by the youngest student. In his lectures his diction was a model of English; no straining for effect, no struggling for words, but the right word always in the right place. "I never think of the words I am to use," said he. "I arrange the matter, order, and method of statement and illustration clearly in my mind before I begin, and then the words come of themselves."

It was fortunate, also, that he had that charm of manner—modesty, simplicity, manliness, and kindness for others—which attracted and captivated his audience. In fact, it was fortunate for popular science that he was—Agassiz; for men with such a rare combination of good qualities, and such a position, come but seldom in a century.

One of the branches of scientific investigation to which he gave much actual examination and earnest thought, and by which he will be known as the great expounder, was the extent of glacial action during the period when the greater part of the northern and southern continents was under an ice-sheet of immense thickness. He first grasped the full force of the problem, and enunciated it; and his demonstrations have made clear many existing conditions on the surface of the earth, which had baffled the skill of others. Perplexities melted before it, and from chaos are emerging order and consecutiveness. In his visit to this Coast, he was particularly gratified and excited with the evidences of glacial action which mark our Sierras, and which I have shown to mark our coast-line. These, the existence of the great living glaciers of British Columbia and Alaska, and the evidences of glacial action through the thousand miles of ocean Yosemites stretching from latitude forty-seven to sixty, were some of the inducements that led him to acquiesce in the projected trip of this season. He had studied the glacial action through similar geological formations from Cape Horn northward, and, from his comprehensive knowledge and grasp of the subject, was peculiarly fitted for the discussion. Even among those who may be capable of seizing the minutiæ of evidence and realizing the magnitude of the powers which performed that work, it may be many years before any one can command the means and the time for their examination and elucidation. It requires a rare combination of qualifications for its solution, particularly that of the mechanical faculty; and we can but hope that from among our young students of California will come those who can demonstrate it successfully.

I close with a few words of a power which he possessed, so unusual among scientific men, yet so absolutely necessary for the development of science as understood by the specialists, and of knowledge as taught by the colleges, that we can but pray without ceasing his mantle may fall and cover many shoulders. Others possess it—perhaps only differing in degree—or the magnificent endowments which have been made to our higher seats of learning would have been devoted to other purposes. Yet he first made the claims of science a demand upon the affluent who had grown wealthy through the practical applications of scientific investigations and discoveries. He would admit of no compromise measures—science had taken a back seat too long; her

votaries had been sneered at as particularly deserving reprobation for lack of the money-making faculty; and he repudiated the supposed eleemosynary character of the gifts grudgingly made to her. He boldly stood forth as the champion of the self-sacrificing devotees of science. For the benefit of human knowledge he had given, with unsparing prodigality, the mental and physical activity of a life noted for its remarkable vigor, endurance, and consecutiveness; and his sense of justice was aroused to appeal for help to those who could so easily and so largely endow our colleges and universities, our museums and academies of science. You have listened to these appeals, and know that even in our midst they have not been in vain. Throughout our country the leaven has reached the treasures of large-minded men who, during their life-time, wish to see the fruition of their nobler instincts. In the last ten years, millions of dollars have been devoted to learning and science; but many more millions are needed, and the apostles of science must cease not urging and proving her claims. Our University alone needs its million for buildings, apparatus, and museum; and another million for the endowment of professorships. Our Academy needs as much for buildings, collections, and for foundations for original research. And in our midst we need an amply endowed Institute of Technology.

The interest which he imparted to science on this Coast, in one short visit, has steadily increased. The cheering words which he spoke in our behalf have fallen upon the hearts of our people, and awakened their sympathy. The Academy certainly has cause to rejoice in its benefactions; but we need still more freely the helping hand of endowment, to realize what he prophesied.

We can listen no more to the magic of his voice; but his example is ever before us. Words of praise can add nothing to his glory; but we can honor his memory by imitating his fervid devotion to science, and its diffusion among mankind. It never faltered; it pervaded his being.

He was the incarnation of Science; and greater love hath no man than this —he laid his life down for it.

He has gone; but his name will be a land-mark in human knowledge through the long roll of centuries.

Remarks of Professor D. C. Gilman.

The name of Agassiz does not belong to the learned alone, though it is honored most by the wise and the profound; it likewise belongs to the common people, for it is a household word throughout the land.

Few men, while they live, attain renown among the multitude, and also retain their eminence among philosophers; but he wore fitly this double crown —"the praise of praised men," which is gold, and the applause of the unlearned, which is silver. How few of those whom we call distinguished, whether writers, teachers, statesmen, merchants, scholars, or leaders in arms, are equally known and honored with this college professor, this comparative

zoölogist, this interpreter of nature! The news of his decease has brought to learned societies and to common schools, to universities and to fishermen's cottages, the sense of a personal bereavement, for it tells of the loss of a guide, the death of a friend.

To these twofold aspects of his character, your attention will now be directed; the speaker who follows,* by our mutual understanding, rehearsing the claims of Agassiz to scientific renown, while I am to dwell upon his claims to popular regard, or rather upon his character as a teacher, and the influence he has exerted upon American Education.

It will be generally admitted that, among all the teachers of the land, he has held the foremost place. Notwithstanding that ours was to him a foreign tongue, that he grew up to the prime of life under European institutions, and that the subjects which he taught were quite remote from what are called the "practical" wants of the Americans, he always spoke among us with that extraordinary power of adaption, that easy self-possession, that rare adjustment of thoughts and words to the occasion, which constitutes true eloquence—which attracts, enlightens, delights and persuades. Before the Legislature of Massachusetts or the National Academy of Sciences, in the college lecture-room or in the teachers' institute, on the public platform or in the private parlor, in the open field or on the vessel's deck, he was always the same—ready, graceful enthusiastic, earnest, suggestive, and instructive. He delighted to learn, that he might teach; to teach, that he might learn.

When such a man departs, old, honored, unsullied, and beloved, it is well to inquire into the antecedents of his character, the elements of his renown.

It is not every teacher who is endowed with a good constitution, neither too nervous, nor too phlegmatic. Agassiz was fortunate in his physical character, his noble figure, his beaming countenance, his elastic step, his excellent health. He was not of that type of scholars whose shriveled faces and whose withered forms declare the neglect of exercise, and the misuse of food; nor was he one who gained by stimulants extraordinary force. He possessed what might be called a commanding presence, a favorable personal equation, a magnetic influence, a manly beauty, or an easy dignity—a quality not to be defined, but everywhere appreciated, which may be in-bred, yet must be first in-born. He came of good descent, having a mother of rare intellectual qualities, and on his father's side an ancestry of six generations of Protestant ministers, going back to the Huguenot refugees. But his was not the parentage of wealth or fashion, and the narrow circumstances of his early life quickened his industry, his patience, and his persistence, and fitted him forever after to sympathize with and encourage those who have high aims and shallow purses.

His early culture was most liberal. In many countries, and through many years, his studies were prolonged. Four years, the record runs, in the gymnasium at Brienne, two years in college at Lausanne, two years in the medical school at Zurich, five years in the universities of Heidelberg, Munich, and Erlangen, that is, thirteen years, at least, of preparation in the period of youth.

* Prof. Joseph Le Conte.

Thus he came in contact with some of the most renowned naturalists in Europe—Cuvier, Humboldt, Martius, Spix, and a host besides—and received that intellectual impress from superior minds which is far more influential than a library full of books, or a city full of museums.

Hence he laid a broad basis for his scholarship. Ancient and Modern Languages, Philosophy, Human Anatomy and Physiology, Botany, Mineralogy, Geology, and Zoölogy, were all pursued with such enthusiasm, that in any of these departments he might have been distinguished.

So was he qualified to teach—by natural endowments, personal presence, honorable ancestry, narrow circumstances, prolonged culture, and broad foundations. What, now, were the consequents of such antecedents—the superstructure on such a foundation?

There was supreme kindliness or self-control in his disposition, which led him to be patient with ignorance, and what is harder yet, with arrogance; which made him generous in bestowing his time, his learning, and his letters upon others; which made him accessible to the most timid student, or the most humble discoverer of a curious bug.

To this was added a charming enthusiasm, which gushed forth in no spasmodic intermittence, but bubbled up perpetually with refreshing effervescence. He captivated all whom he met. He made them believe that his work was his play; that they might engage in it with a surety of reward. He seemed to say perpetually to his associates, as Faraday said to Tyndall, under untoward circumstances: "Our subjects are so glorious, that to work at them rejoices and encourages the feeblest; delights and enchants the strongest."

Genuine gratitude was also conspicuous in all he did. The school-boy who brought him an uncommon fish, or the farmer who sent him a nest of turtle's eggs, or the woodsman who favored him with a family of little rattlesnakes, was as sure of his hearty acknowledgments as the millionaire of Boston who endowed his museum, or the tobacconist of New York who bought for him Penikese Island, or the officers of the Government who placed at his command the resources of the Coast Survey. No emperor or king ever received such homage, voluntarily bestowed by high and low alike, or such tributes from the united realms of earth, and air, and sea; none return such gratitude. This gratitude was marked by unmistakable sincerity. His looks, and tones, and the pressure of his hand, all confirmed the utterance of his lips. No one need fear that when the private letters of Agassiz are made public there will be anything to regret, as there was in the posthumous revelations of one of his most illustrous contemporaries.

There was, moreover, a hearty co-operation with other workers, and in other spheres—a friendly indorsement of their efforts which was free from the tone of patronage or of interference. The members of this Academy must well remember the generous words which he uttered on the evening when he first set foot in San Francisco—his congratulations at the success of the Academy, his words of encouragement for the University, and his eulogy of the Geological Survey, the pride of all the science of the State.

Still more remarkable in Agassiz was his readiness to aid in the diffusion of knowledge. Devoted as he was to scientific researches—to the advancement of learning by investigations of the most profound sort, extending down to the lowest organisms at the bottom of the sea, and back to the remotest æons of geological history—he was always ready to come before the public and bring the newest and the best of his acquisitions. There are such men as intellectual misers, but he was not of that race. There are also those who are deaf and dumb, but he used all his faculties. He did not wait for costly diagrams or extraordinary specimens. A blackboard and a piece of chalk were all the apparatus which he required for a lecture on Natural History. At the oldest University in Cambridge, or at the newest in Ithaca, through the *Atlantic Monthly* or the extra *Tribune*, in the National Academy, or on Penikese Island, in the State-house at Boston, or in Pacific Hall at San Francisco, he was ready to teach all who wished to be taught. The wisest would enjoy the clearness, the liveliness, and the method with which he told his tale; and the uninformed would think they were growing wise, because they could follow so agreeably and intelligently the utterance of a master. He believed in the Public Schools; and the newspapers say that one of the last acts of his public life was to give a lecture at a teachers' meeting.

As a popular teacher, Agassiz was undoubtedly aided by his devout reverence, which saw in Nature something more than a force or law, or rather, which believed all law and force to emanate from a Law-giver and a Ruler. He did not obtrude these opinions. He was not more fortunate than other men of science in escaping the attacks of bigotry and superstition; but now and then, like a church-bell tolling on a Sabbath morning, deep utterances would come forth expressive of his faith. For example, at the close of his essay on "Classification," occurs this passage: "All the facts proclaim aloud the one God, whom man may know, adore, and love; and Natural History must in good time become the analysis of the thoughts of the Creator of the universe, as manifested in the animal and vegetable kingdoms." (*Contribution to Natural History of the United States.*)

Thus we see that the supreme kindliness, charming enthusiasm, genuine gratitude, unmistakable sincerity, uniform co-operation, incessant desire to diffuse as well as to advance knowledge, and devout reverence, were among his most conspicuous qualities as a teacher. I do not dwell upon his love of truth, for that is fundamental with all real men of science; nor on his abstinence from money-making, for all legitimate university life precludes the professor from wild speculations on the one hand, or from regular business responsibilities on the other; nor do I dwell upon his love of studies remote from their practical bearings, for the student of Nature never knows what profound benefits to mankind may proceed from the most abstract research. In these respects I do not know that Agassiz differed much from other naturalists, but in native gifts, and in the acquisitions of varied culture, there are but few to be compared with him.

Hence he has exerted a powerful influence upon American education. It is true that he was fortunate in colleagues and in circumstances. Guyot came

with him to this country from Switzerland, and in a different sphere, and with different intellectual endowments, has shown many of the qualities which distinguish his life-long associate. Their united work among the teachers of Massachusetts will always be gratefully remembered by the friends of popular education. Dana, when Agassiz arrived, had recently returned from his voyage around the globe, laden with rich treasure of thought and observation, and in his enlightened and impartial conduct of the *American Journal of Science*, was a powerful ally in the promotion of all departments of scientific education and research. Bache and Henry, at the head of two great departments of the Government, the Coast Survey and the Smithsonian Institution, were able to turn the national resources toward the same great purposes. Torrey and Gray had already given world-wide reputation to American Botany, and Pierce had advanced the science of Mathematics. The gifts of Lawrence, and Sheffield, and Peabody, successively brought new and advantageous impulses to the study of Natural History. The explorations of the Western States and Territories, the settlement of California, and the surveys of the Pacific Railroad route, created a demand for trained geologists and naturalists. Young men were attracted to Cambridge by the renown of the Swiss professor, and, after learning wisdom in his laboratories, went off to found and develop new institutions in Salem, Boston, New Haven, Ithaca, and Oakland, or offered themselves to the service of the State or nation. Teachers in the common schools, especially in New England, learned how to awaken an interest in the study of Nature. Congress, in 1862, made a generous provision for scientific schools; and now, a quarter of a century from the coming of Agassiz, scientific courses run parallel with classical courses in most of the colleges of the country. I am far from attributing all this progress to any individual. It is the movement of science, in a new country, and in the nineteenth century; but I do not hesitate to say that among all the great and serviceable men who have helped on this spirit of research and of investigation, none is more worthy of grateful homage than Louis Agassiz. Especially was he noteworthy for his opposition to the rote-teaching in scientific text-books; for his encouragement of local studies—researches about home; and for his persistent employment and recommendation of the art of drawing as an indispensable aid in scientific research.

If I may be allowed to make an allusion to my own relations with Professor Agassiz, I will say that the greeting which you gave him, and the greeting which he gave me in the halls of the Academy, fifteen months ago, filled me with assurance and courage. It was not long afterward, before his visit here bore fruits, and the liberality of Edward Tompkins, of Oakland, endowed in the University of California a professorship which is to bear in all time the name of Agassiz. Scarcely two months ago I sat in his study at Cambridge, and answered his inquiries about California, and the friends whom he met here. I congratulated him on the recovery of his health, and heard his declaration that he had at his command all the funds which he could well employ for two years to come. Scarcely ten days have passed since I received from an Eastern society a request, which was made at the suggestion of Agassiz, that I would prepare,

or cause to be prepared, a paper on the commerce of the Pacific in its relations to San Francisco. Then came the telegram that he was gone.

Agassiz is gone! His name is henceforth enrolled among the immortals. Whatever personal deficiencies he may have had, whatever of the imperfections or weaknesses which belong to humanity, will soon be forgotten, and his worth will be more apparent as the years roll on. Hereafter he will be remembered with Linnæus, and Cuvier, and Humboldt, and others, whom the world delights to honor for their scientific researches; with Franklin, and Rumford, and Faraday, who have made popular the sciences which they have likewise advanced. So we lay upon his tomb our perishable garland, and say, Farewell, philosopher and philanthropist! Farewell, our teacher and our friend!

Remarks of Professor Joseph Le Conte.

Mr. President and Gentlemen, Members of the Academy of Sciences: I respond the more willingly to your invitation to say something in honor of Professor Agassiz, because I owe personally so deep a debt of gratitude to him as my teacher. For some fifteen months in the years 1850–51, as his private pupil, I spent the whole working hours of nearly every day by his side, either in the laboratory, or else in excursions along the shores of Massachusetts, or over the mountains of New York, or on the reefs and keys of Florida. The result of this long intimate association was, on my part, a great and ever-increasing love, admiration and reverence for him, both as a scientist and as a man, and on his part, I am sure, a very strong and affectionate regard. It would be very pleasant to me to linger here a moment—to speak of him as a man and a teacher; the contagiousness of his enthusiasm, the abundance and suggestiveness of his thoughts, the greatness of his intellect, far greater even than his work, and, therefore, contrary to what we find in little great men, the increase of his intellectual stature as you approached him nearer and nearer. It would be pleasing to me to linger here, but I have a higher duty to perform, and one which I am sure would be more pleasing to him. In speaking of a man of science, before a scientific body, it seems to me peculiarly appropriate that I should try to show the *true grounds of his great reputation, and the reasons for believing that it will be permanent.*

In the noble army of science—that army so compactly organized for the conquest of darkness and the extension of the empire of light—there are many valiant fighters, but there can be but few *leaders*. In the construction of the great temple of science—that eternal temple made without hands—the only temple ever erected by man worthy to be dedicated to the great Author of nature—there are many busy, eager, joyous workmen, but there can be but few *master-builders*. Now, I wish to show that in the construction of the temple of science, Agassiz was not only an indefatigable worker in all the lowest details, with chisel and hammer and trowel, in brick and stone and mortar, but also a great *master-mason;* that in the army of science he was not only a valiant fighter in the very front rank, but also a *great leader*. In a word, I wish to show that he was not only an indefatigable enthusiastic worker in all the lowest details of his

chosen science, observing, collecting, arranging, analyzing, classifying, but also a *great philosophic thinker*—that his life and work form an epoch in science—that in looking back over the track of time, his gigantic stature will remain for many ages to come a conspicuous landmark.

As we look back over the history of science, we see, at long intervals, certain men who seem to tower far above their fellows. In what consists their greatness? They are men who have introduced *great ideas* or *new methods* into science—ideas which extend the domain of human thought, or methods which increase our power over nature, facilitate the progress of discovery, and thus open the way to the conquest of new fields. Such men were Copernicus, and Galileo, and Kepler, and Newton, and Herschell, in astronomy: such were Linnaeus, and Buffon, and Cuvier and Agassiz, in organic science.

Let me illustrate the effect of the introduction of great ideas into science. I will select one example from astronomy, and one from geology.

Before the time of Copernicus and Galileo, this, our earth, was *all of space* for us. Sun, moon, and stars were but little satellites revolving about us at inconsiderable distance. Astronomy then was but the *geometry* of the heavens, the geometry of the curious lines traced by these wandering fires on the concave board of heaven. But with the first glance through the telescope, the phases of Venus and the satellites of Jupiter revealed the existence of other worlds beside our own. In that moment the fundamental idea of modern astronomy, the idea of infinite space filled with worlds like our own, was fully born in the mind of Galileo. In that moment the intellectual vision of man was infinitely extended.

Again, before the time of Buffon and Cuvier, this, our human epoch, the history of our race, was *all of time* for us. Shells and other remains of marine animals had, indeed, been found far in the interior of the continents, and high up the slopes of mountains, and there had been much speculation as to the origin of these. Some may have thought by means of these to extend the limits of our epoch, but none dreamed of other epochs. Some may have thought they were discovering new coast islands along the shores of time; but none dreamed that these were the evidences of new worlds in the infinite abyss of time. It was reserved for Buffon and Cuvier first to recognize the entire difference between fossil and living species. In that moment was born the fundamental idea of geology, the idea of infinite time containing many successive epochs, or time-worlds like our own. In that moment the intellectual horizon of man was again infinitely extended.

These two are the grandest moments in the history of science; yea, in the intellectual history of our race. The one opened the gates of infinite space, and showed us many space-worlds; the other opened up the gates of infinite time, and showed us as many successive creations or time-worlds.

We see, then, the intellectual impulse communicated by a great new idea. The introduction of a new method, though less striking to the imagination, is perhaps even more important. We will illustrate it presently. Now, I wish to show that Agassiz, too, was the originator of new ideas, and the introducer, or

at least the perfecter, of new methods in science. Yes, Agassiz was the originator of a great new idea in geology, and the introducer or perfecter of a new method in organic science.

For nearly a century past, glaciers, their structure, their mysterious motion, and their effects, have been the subject of the intensest interest to scientists; an interest which is deepened by the splendors of mountain scenery and the perils of mountain travel. The most eminent men have successively expended their energies upon these problems: De Saussure, and Charpentier, and Huger, and Agassiz, and Guyot, and Forbes, and Tyndall. To the physicist, the two points of greatest interest are, the *law* of glacier motion and the *theory* of glacier motion. Now, in the din and confusion of discussion, as to whether Agassiz or Forbes first discovered the true *law* of glacial motion, and as to whether Forbes or Tyndall advanced the true *theory* of glacial motion, it seeems to have been almost forgotten that to Agassiz and Guyot is due the credit of something far greater than either the law or the theory of glacial motion. I put aside with bare mention the immense mass of accurate observations accumulated by Agassiz, and embodied in his great works—the "Etudes des Glaceers" and the "Système Glacière," a treasury from which all subsequent writers have drawn. I put aside also all questions as to the laws and the theories of glacial motion, important as they are, as trifling in comparison. I desire to fix your attention on only one great idea introduced by him, viz: the idea that glaciers are now, and have been to a much greater extent in a previous epoch, *a great geological agent*, sculpturing our mountains and determining the forms of our continents.

Let me trace the history of this great idea. Agassiz and Guyot had studied minutely the evidences of the former extension of the glaciers of Switzerland. Guyot had even traced the outlines of these ancient glaciers, and thus established the existence of a glacial epoch in that country. With these results still fresh in his mind, Agassiz visited England in 1844 or 1845 (I know not the exact date, nor is it important), and quickly recognized the footprints of glaciers all over the mountains of Wales and Scotland, and astonished the world by announcing that these regions were moulded beneath an ice-sheet. In 1846 he came to this country, and again tracked the steps of glaciers all over the surface of New England, and again astonished the world by announcing that all the northern portions of the United States were also moulded beneath an ice-sheet. It is unnecessary to trace the extension of this idea from country to country; suffice it to say, that it was soon recognized that there was a glacial epoch not for Switzerland only, but for the whole earth. Before Agassiz, the study of glaciers was the study of nice questions in physics, and of interest principally to special physicists. Agassiz transferred the whole subject into the broad domain of geology, and gave it a far deeper, broader, and more general interest. The result was not only a powerful impulse to the study of glaciers, but a flood of light shed upon the whole later geological history of our earth, and thus an enormous impulse to geology also.

But I said that Agassiz was a great reformer in zoölogy also—that he was also, if not the first introducer, at least the perfecter of the great method of

organic science. This must ever remain the chiefest glory of Agassiz. Yes, far greater than all his great works in zoölogy—as great as these are, a monument of industry and genius—far greater than these is the *method* which underlies them, and which has impregnated all modern zoölogy.

Let me pause a moment, in deference to the intelligent but unscientific of this audience, to explain the meaning and show the power of scientific methods. Scientific methods bear the same relation to *intellectual* progress which machines, instruments, tools, do to *material* progress. The civilized man is not superior to the savage in physical strength. The wonderful mechanical results achieved by civilized man are possible only by the use of *mechanical contrivances*. So, also, the scientists differ from the unscientific not by any superior intellectual power. The astounding intellectual results achieved by science have been attained wholly by the use of *intellectual contrivances*, called methods. As in the lower sphere of material progress, the greatest benefactors of our race are the inventors or perfecters of new mechanical contrivances or machines; so in the higher sphere of intellectual progress the greatest benefactors of our race are the inventors or perfecters of new intellectual contrivances, or methods.

To illustrate the necessity and power of method, take, for example, the method of *notation*, characteristic of mathematics. How simple the contrivance, and yet how powerful! Nine numeral figures, having each a value of its own, and also a value depending upon its position: a few letters—a and b, x and y, connected by the symbols $+$ and $-$: that is all. And yet by the use of this simple contrivance the dullest boy in your public schools may accomplish intellectual results which the greatest philosophic genius could not otherwise attain. As soon as we leave the field of abstract thought and rise into the field of phenomena, *observation* commences. But as in the field of pure thought, thought can accomplish little without method; so in the field of phenomena, observation can accomplish little without the assistance of method. The phenomena of the external world are so complex, so affected by disturbing forces and conditions, that in order to be understood, they must first be simplified. The scientist, therefore, by *experiment*, removes one condition after another, and one disturbing force after another, until the true cause and necessary condition is perceived. This is the great *method of experiment*, upon which rests the whole fabric of physics and chemistry. But when we rise still higher into the field of organized bodies, the phenomena become infinitely more complex and infinitely more difficult to understand without the assistance of method, and yet, just here, the method of experiment fails us, or, at least, can be used only to a very limited extent. The conditions of life are so complex, so nicely adjusted, so delicately balanced, that when we attempt to introduce our rude hands in the way of experiment, we overthrow the equilibrium, we destroy the very conditions of our experiment, viz: life. In this dilemma what shall we do? Fortunately, nature herself prepares for us a most elaborate series of experiments. The phenomena of life in the higher animals and plants are indeed far too complex to be understood; but if commencing with these we go down the scale, we find these phenomena becoming simpler and simpler until they

reach the simplest expression in the microscopic cell or microscopic spherule of protoplasm. The equation of life is reduced to its simplest terms, and then, only, we begin to find the value of the unknown quantity. This series I will call *the natural history series.* Again, nature prepares for us another series of experiments. Commencing with the *mature* condition of the higher animals, and going backwards along the line of individual history through the stages of embryo, egg and germ, we find again the phenomena of life become simpler and simpler, until we again reach the simplest condition in the microscopic cell. This, I will call the *embryonic series.* Again, that there might be no excuse for man's ignorance of the laws of life, nature prepares still another series of experiments. Commencing with the fauna and flora of the present time, and going back along the track of geological history, through Tertiary, Secondary, Palæzoic and Eozoic, to the very *dawn* of life, we find a series of organic forms becoming simpler and simpler, until we again reach the simplest term in the lowest conceivable forms of life. This I will call the *geological* or palæontological, or evolution series.

Now it has been by extensive comparison in each of these series up and down, and by extensive comparison of the three series with each other, that our knowledge of organisms has gradually become scientific ; that mere accumulation of facts and phenomena has grown with science ; that a mere heap of useless rubbish has been changed into a beautiful edifice. This is what is called the *method of comparison*—the great method used in the science of life. Yes, anatomy only becomes scientific through *comparative* anatomy. Physiology only becomes scientific through *comparative* physiology ; and I may add, psychology will never become scientific except through *comparative* psychology.

So much I have said to show you the nature and power of scientific methods and especially of that method—the method of comparison—upon which rests the whole fabric of the science of organisms. Now what has Agassiz done in perfecting this method ? I will attempt to explain.

We have seen that this method consists of *three subordinate* methods which lead to similar results, viz : comparison in the three series, the natural history series, the embryonic series, and the geological series. Now Cuvier and his colaborers introduced and perfected comparison in the natural history series and thus laid the foundation of scientific zoölogy ; but Agassiz and Von Baer and their co-laborers extended the method of comparison into the embryonic and geological series, and also into the relation of the three series to each other ; and thus greatly perfected the method and increased its power. Others, no doubt many others, assisted in the great work, but Agassiz was unquestionably the leader in the movement. For forty years Agassiz worked incessantly, enthusiastically—even to the breaking down of his strong physical constitution and the sacrifice of his life—on the ideas and the methods conceived in his youth. *Is not this a great life ?*

Finally, let us glance at some of the results of Agassiz' method. The *direct* result is too familiar and obvious to dwell on. We see it in the amazing impulse given to Biology and its consequent great and ever-increasing progress in

recent times. I will only very briefly draw your attention to the *indirect* results, *i. e.*, results which were not in the mind of Agassiz nor aimed at by him.

1. Agassiz' work and Agassiz' method prepared the whole ground and laid the whole foundation for the modern doctrine of evolution. The idea of the *similarity* of the three series mentioned above—the natural history, the embryonic, and the palæontological—and therefore *the light which each sheds on the others*, a view so long insisted on by Agassiz and so tardily and grudgingly accepted by zoölogists, forms the whole scientific basis, and comparison in these three series, the whole scientific method, of the theory of evolution. Evolution is development. Evolution of the organic kingdom is development of the organic kingdom through geologic times. No one insisted so long and so strongly on development of the organic kingdom through geologic times, as did Agassiz. All that is grandest and most certain in evolution, viz: development from lower to higher, from simpler to more complex, from general to special by a process of successive differentation, has always been insisted on by Agassiz, and until recently only grudgingly accepted by English zoologists and geologists. In this sense, therefore, Agassiz is the great apostle of evolution. It was only the *present theories* of evolution, or *evolution by transmutation*, which he rejected. His was an evolution not by *organic forces within*, but according to an *intelligent plan without*—an evolution not by *transmutation* of species, but by *substitution* of one species for another. In the true spirit of inductive caution, perhaps of excessive caution, he confined himself strictly to the *formal laws* of evolution, and no man has done so much in establishing these as he; but he regarded the *cause* of evolution as beyond the domain of science, and all attempts at a *causal* theory as at least premature if not altogether vain.

2. Agassiz' work and Agassiz' method has laid the only foundation of a possible scientific sociology. Society also is an organized body, and therefore subject to the laws of organisms. Society, too, passes by evolution from lower to higher, from simpler to more complex, from general to special, by a process of successive differentitation. Society *progresses, develops*. This is the most glorious doctrine of modern times. The phenomena of society, however, are even more complex than those of organisms, and therefore still more in want of a method. But we have already seen that phenomena which are too complex to be analyzed by experiment can only be brought into subjection by the method of comparison. If, then, there shall ever be a scientific sociology, it must be by the use of the same methods which are used in biology; it must be by the comparison of social institutions, governments, civilizations, etc., in all stages of development; it must be by extensive comparison of social phenomena in *three series*, first, as exhibited in *different races and nations* in various stages, as now existing in different places, corresponding to the natural history series; second, as exhibited in various stages of advance of the *same nation* from barbarism to civilization, corresponding to the embryonic series; third, as exhibited in the slow onward progress of the *whole race* through rude stone age, polished

stone age, bronze age, and iron age, corresponding to the palæontological series. It is by comparisons of this kind that Herbert Spencer is now attempting to lay the foundations of a scientific sociology. I repeat it: if sociology ever becomes a science it will owe much to the genius and the method of Louis Agassiz.

Owing to the illness and consequent absence of Mr. Stearns, the following from him was read by Prof. E. S. Carr:

Remarks of Robert E. C. Stearns.

Mr. President.—It has pleased you to insist that I should add something to the general expression of sorrow and of eulogy. It is in no spirit of reluctance that I hesitate to bear testimony to the merits of him to whose voice it was so pleasant to listen, and in whose presence it was a pleasure to be; but rather from the fear of my inability to render an even measure of justice to the dead.

Without enlarging upon those exterior characteristics by which he was known, and which, ennobled by a generous nature, gave grace and dignity to his person, we find with and above these attractions a moral and intellectual greatness and simplicity, which endeared him to his fellow-men.

I cannot recall the name of any other scientific man, which has been so often spoken, and with so much respect and affection, in the homes and families of our people, as that of Agassiz.

This respect and affection arose, not alone from his intellectual achievements or from the popularity of his lectures and writings, but from that large-heartedness which made him accessible to all.

In his intercourse with his fellow-men, he graduated his speech not by the rank or station of the person, for each and all were received with unmeasured courtesy and kindness.

Such intellectual breadth, moral excellence, and estimable qualities as he possessed, are seldom found in the same person; and these made him not only an impressive and attractive teacher, but, combined with enthusiasm, inspired all with the desire to serve and assist him; hence, in part, that vast aggregation of material at Cambridge, beyond the capacity of the present building for its proper arrangement and display.

What wonderful progress has been made in our country since the arrival of Agassiz, in 1846! Its material wealth how enormously increased, broad areas peopled, new States established, and the march of empire pushed westward to the sea. At that time for the year of his arrival may be regarded as a notable and important event in the history of the country, within a few rods of this spot, the waters of the Bay rippled along an almost untrodden beach. Do you remember his concluding remarks at the Academy's rooms, on that September evening, a little more than a year ago? He said: "When I saw to-day, for the first time, San Francisco through the Golden Gate, I was amazed. I look upon it as one of the marvels of modern times that there should be a

city standing upon these shores, so grand, so prosperous, so rich, and so young." Great and manifold as are the changes we have noticed, great also has been the progress of science and intellectual advancement in the nation. The increased and constantly increasing interest in scientific study and literature is most marked and astonishing.

I cannot but remember, and with regret, that when a boy some thirty years ago, when first I became interested in the study of natural history, there were neither books nor teachers. How often have those early disadvantages been brought to mind, from time to time, as in after years I added to the muster roll of friends, the names of younger men who were privileged to sit under the teachings of the great master.

As some good mother, by the fireside's glow, spreads the new book upon her lap, and, calling her children near, points out the pictures and explains their meaning; so he, with radiant face and winning voice, gathered around him those nature-loving boys, and, opening wide the book of the greater mother, page by page, pointed to its living illustrations—explained their history and their relations, their beauty and their use.

How shall we estimate the value of early training under such a teacher?

Of the earlier students, Stimpson has passed away. He had accumulated, though but forty years of age, the ample store of more than twenty years' investigation. His manuscripts and plates were destroyed by the great fire in Chicago. Of this sad event and its effect upon him he wrote: "My own books, collections, manuscripts, and drawings—twenty years' work—all gone." What a pang must have shot through his heart as he wrote that line! "His old teacher offered him all the resources of the museum at Cambridge, but, with all his old love for the work, his strength was gone."

We may speak freely of the dead, if no evil is in our speech; but delicacy suggests that we should cautiously praise the living.

Other members of the earlier classes are professors and teachers in various colleges and schools throughout the country, or faithfully toiling in some field of investigation. I may not call their names. Many have already acquired distinguished reputation, and all are contributing to "the sum of human knowledge." Some of them are borne upon the roll of this Academy, and share with us the duties of this occasion.

A few days more than eighteen months have gone since Stimpson died; and now the illustrious teacher has followed his old-time pupil, on the same inevitable path.

Shall we not pause, before we say farewell, and review the labors and services of the master, since the day when he made our country his own?

How much, what part of our intellectual growth and material advancement, with its resulting higher and expanding civilization, is due to him?

Of those lofty qualities which lift man above the merely imitative and sensual animal, and place him nearer the divine—in all which makes a people wise and virtuous and a nation great—who has done more to disseminate the seed and encourage the growth than Louis Agassiz?

And now we say, good-bye! The form we knew and called by his name will soon fade away; but the effacing fingers of decay can never mar the record of his noble life.

At the conclusion of Mr. Stearns' paper, Dr. Carr remarked as follows:

Yes, Mr. President, Agassiz is not dead. He has gone to sit with Humboldt and Cuvier, with Plato and Aristotle, among the stars; the voice of humanity, echoing down the corridors of time, and gathering fullness through the coming ages, will ever proclaim as long as a love of knowledge endures—*Agassiz still lives.*

Remarks of Rev. Dr. Horatio Stebbins.

Mr. President, Ladies and Gentlemen: It would not be appropriate to me in this presence, and after what has been said by those who have preceded me, to undertake to give a *resumé* of Agassiz' scientific thought, or to sketch his career as one of the great interpreters of Nature's law; but while I have been sitting here listening to the words of others, and looking into your faces, I have been impressed anew by that cheerful, harmonious accord of reason, intelligence, and all magnanimous sentiments with which we acknowledge human greatness. With what refreshing admiration—with what proud, grateful, sympathizing joy do we stand on these level plains of existence and look up to those vast mountain ranges whose solitary summits attest man's intellectual and moral grandeur, and the permanence of truth! It is the felicity of the scientific man, that the truth he seeks is cosmopolitan. It knows not state or nation, tribe or race, but is world-truth and world-law. The distinguished representatives of that truth have a clear atmosphere, and if their moral nature is strong enough to sustain itself in those rarified heights, they lead a life of singular dignity and freedom, their minds dashed with no color of prejudice or passion—seeking what is. To know what is in the world of things, is the vocation of the man of science. His reputation is the reputation of truth, strong and still as the sun; and his name is the property of mankind. In the enthusiasm of admiring grief, we accord to our late illustrious fellow-citizen and cosmopolite such a place and such a name.

Far back, ascending the centuries, in the very horizon of man's intellectual history, is Aristotle, in whose mind the seeds of the universe were planted, who compassed all the knowledge of his time, and gave the hint to future ages. Two thousand years later is Humboldt, who, with matchless wonder of comprehension and penetration—with a persistency of purpose and idea, pursued, without a parallel in the life of man, through a period of nearly seventy years of original research—constructed a "Cosmos," the science of the relation of things, which is perhaps the source of more of the knowledge of the modern time than has come from any other single mind. In our own time, and in the near distance of

the present, is Agassiz, who, coming forward at a period when science was so complex as to render universality impossible, devoted himself to the investigation of the living forms upon the surface of our globe, and to finding the thread of order and law running through all organized beings. His mind was at once incisive and comprehensive, analytic and synthetic; while a fine glow of poetic insight and feeling suffused his whole intellectual and moral frame. It was this poetic nature, expressed in elevated, restrained enthusiasm of purpose and idea, that enabled him to give such an impulse to scientific studies in America. He had the rare ability of pursuing original research and of transforming it into popular knowledge—a hazardous undertaking for some, inasmuch as the popularization of science is accomplished through dense and refracting media, which impair intellectual rectitude and degrade the scientific standards of truth to practical and economical relations. To extend the domain of science is one thing, to diffuse science is another thing; and the two are rarely united.

Agassiz claims my admiration for the firmness and simplicity with which he maintained the right of science to pursue its own investigations in its own domain, without controversy, and without reference to any prejudices or opinions that might be held in any other department of knowledge or experience. With the old conflict between science and religion he had nothing to do. He had frankness and truth enough to confess that there is as much dogmatism in science as in religion; but he knew that essentially there is no conflict between them, and never can be. Their boundaries are undefined, as the boundaries between the known and the unknown, the apprehended and the comprehended, always will be. It is one of the infirmities of the human mind to become provincial in its conceptions of truth, and to judge the universe of things by the standards of its own village experience. Agassiz did much to enlarge and enlighten the mind, by teaching that the outward world is an expression of the thought of God, and that man's science is the discovery of God's law.

He was indeed a light and a life! That life has finished its earthly course, and that light is extinguished from our earthly horizon. It must be considered a happy event to us here, that he visited once these western shores. It is a privilege to have seen him; as it is a profound satisfaction to feel that the distinguished expressions of human nature are of kindred blood with ourselves. As I looked on him and called to mind the recollections of former days, admonished of the malady that was destroying him, I grieved for living men; but I did not grieve for him—there was so little of him that could die.

Remarks of Rev. Dr. W. A. Scott.

Mr. President, Ladies and Gentlemen: I did not know till I entered the hall this evening, that I was expected to have the honor of saying a word to you on this interesting occasion, but being urged to appear on the platform I could not absolutely refuse, because as a citizen it was in my heart to honor, as far as in me lay, this memorial meeting, and as a member of this Society to aid in tendering our respects to the memory of our illustrious dead. Another reason for

opening my lips is to endorse the sentiments of Rev. Dr. Stebbins, just uttered in regard to the alleged or supposed antagonism of science to revealed religion. Believing as I do, as intimated in the reference made to the opinions of the late Louis Agassiz, that there is as much *dogma* in science, or even more than in religion, I am ready to say and boldly maintain that there is not, and cannot be, any real antagonism or controversy between true science and true religion. All truth is of God and is a unit. Science and religion are twin sisters from the throne of the Eternal Lawgiver. There is no real controversy between them—no strife but as to which branch of knowledge can do most for mankind. Properly interpreted, they come from the same glorious hand and tend to the same result—the happiness of mankind and the glory of the Creator. I honor science, and heartily bid God-speed to every honest investigator of the laws of the universe. As a theologian I have never had the slightest fear concerning the advance of true science. Our natural philosophers cannot travel so far but they will find the Creator has been there before them; and as they climb through space and journey among planets and systems unnumbered, they will all find that the ladder by which they have ascended to the very outposts of the universe was built for them by the hand of an all-wise Lawgiver possessed of supreme intelligence, will, and power. No, ladies and gentlemen, there is no real controversy between true science and religion. Their mission is one—the progress of mankind to a higher degree of knowledge and sincere purity. I have ever believed in free thought, free speech, and a free press—not *toleration*, but absolute freedom. It is thought that governs the world.

But he must be a braver man than I claim to be, who would undertake to entertain such a presence as this at such a late hour, and especially after the learned and eloquent remarks that have been made by the gentlemen who have preceded me, even if I had an address prepared, which I have not. All I can venture to say is, that in doing honor to our distinguished fellow citizen, we honor ourselves. Some nations honor their dead in one way, some in another. Some build monuments or found institutions to perpetuate their names to coming generations. The eloquent addresses already delivered have told us of the exalted character of our great scientist as a man, a citizen in all the walks of life, of the magnetism of his presence and speech, and of his wonderful abilities as a teacher, and of the results or net gains to the scientific world, as the perfecter, if not the original proclaimer, of a *new thought* and of a *new method* of scientific experiments, which are revolutionizing many of the departments of scientific philosophy. We need not then offer a hecatomb at his tomb. It may be true, in a limited sense, as the heathen sages have said, "Those whom the gods love die early," and for us, too early has *Louis Agassiz* passed from us through glory's morning gate to the *great majority* gathering on the shores of "the beautiful river," where the flowers never fade. But not too early for himself, nor for the cause of science to which his whole nature was consecrated. You have been told that the telegraph wires flashed to us the sad intelligence "Agassiz is no more." This is a popular but an erroneous announcement. True, he is no longer on earth to be seen in the high places he so long honored. We shall look no more here upon

his noble form, nor hear his eloquent and burning words, but *he still lives.* He is one of those men who possess two immortalities—one, his own individuality, which he has carried with him to the future state, and the other remains with us in our hearts and in the annals of science to the end of time.

Reference has been made to personal acquaintance with the deceased. I was not as highly favored as some of the gentlemen who have spoken, but happily not altogether without being able to record with gratitude my knowledge of him, and the benefits derived from his lectures. As a disciple, I once enjoyed two full courses of his lectures, on Fishes and Geology, and then sat at the feet of Professor Mitchell, of the Cincinnati Observatory, and afterwards at the feet of Professor Guyot, of Princeton College, so honorably mentioned in your presence. And from these masters of scientific lectures I derived views of the laws of Nature and the works of God, for which I desire to acknowledge my deepest gratitude.

Let us then thank our Heavenly Father for the advance of Science, and for the life, character, labors, and contributions to true science of Louis Agassiz. And as it is a true saying, "They mourn the dead aright who live as they would wish us to live," so let us in our several spheres endeavor to imitate the noble deeds of our illustrious dead; remembering that he said "he had no time to make money." And he was right. Thank God he gave his time, strength, genius, and heart to a far nobler purpose. To make money requires time, skill, and talent. It is a trade—a business—and in its place all right; but it is not the highest calling of man. It is not in itself the greatest good. What is gold, gold to thought, to the enjoyments of a cultivated mind? Like him, then, let us go forth from this memorial meeting to give more of our time, and strength, and substance, to the enlightenment, mental culture, and advancement of our fellow-men, in the knowledge of all truth.

The following from our fellow member, Mr. Henry Edwards, whose engagement elsewhere prevented his attendance, was inadvertently omitted:

Remarks of Henry Edwards.

"O! what a noble heart was here undone,
When Science self destroyed her favorite son."

From a seat of learning in the North has gone forth a wail of sorrow, a wail which echoes not only through the length and breadth of our own land, but in every place in which refinement and culture have found a home, and which will thrill for years to come in many a heart at the mention of the name of the departed. Agassiz is dead. The mighty brain in which grand thoughts were kindled, is, as far as our earth is concerned, at rest for ever; the smile which ever shone on modest merit beams for us no more; the kind and gentle voice which spoke in earnest sympathy with even the meanest endeavor, is hushed and still, and memory is all that is left us of one so loved. To speak in praise of his vast acquirements would be but

"To guard a title that was rich before."

The history of his adopted country will inscribe them on its brightest pages, and his works will be forever cherished amid the records of the nation. But apart from the homage which the worshippers of his genius will surely lay before its shrine—apart from the consideration of the labors which have rendered him immortal, and enrolled his name among the deathless few—there steals into the thought the recollection of that tender and gentle nature which was so magnetic in its association, and which shed so pleasing an influence upon all which came within its contact. Involved in his own cherished pursuits, he scorned the mean pretenses of the world, and being, as he himself declared, "Too busy to make money," he was utterly free from the taint of selfishness, and lived less for his own advancement than for the good of others, preferring the calm enjoyment of a studious and retiring life to the tinsel glories of wealth and display. Mindful of the difficulties which beset the student of Science, and well knowing how willingly the world will sneer at what it cannot comprehend, his hand was ever extended to help the seeker after truth, and to place his feet upon a firm foundation. A father among the young, a brother among the mature, and a kind and gentle friend to all, the name of Agassiz will be loved as his genius is honored, and his childlike nature cherished as his mental powers are valued and esteemed. Above the earth which covers his remains will be mingled the bitter regrets for the loss of one so gifted, and the sighs of sympathy for those who will miss the communion of a loving heart. As on and on we journey towards the end, the pathway of our life is strewn with sorrowing memories; but the blossoms of existence diffuse their fragrance by the wayside, and teach us that all is not sad for those who mourn. The incense of good deeds ascends to Heaven, and the place which so glorious a soul as his filled on earth, becomes a monument for after time, and points to the generations which follow, the shining remembrance of his power. For over fourteen years the writer has held pleasant intercourse with him; has profited by the varied store of knowledge he was ever so ready to impart; and with a saddened soul would add this poor tributary leaf to the garlands which will deck his tomb. He is but one among the many who have felt the friendly interest which Agassiz was wont to display to all who needed the help of such a teacher, and who, in the years to come, will sigh

"For the touch of a vanished hand,
And the sound of a voice that is still."

Mr. W. H. Dall, of Committee, submitted the following resolutions:

Resolutions of the Academy.

WHEREAS, we, the members and associates of the California Academy of Sciences, have learned that it has pleased Divine Providence to call our friend and fellow-member, Prof. Louis Agassiz, away from his earthly labors; Therefore be it

Resolved, That in the death of Prof. Agassiz we recognize the loss of one whose life was passed in earnest devotion to the advancement of Science and the cause of liberal education; whose labors in this field have won for him an

enduring fame throughout both hemispheres; whose efforts in this his adopted country have, more than those of any other individual, contributed to a wide popular appreciation of the dignity, value, and importance of scientific research, and to the necessity of incorporating in our schemes of education, instruction in those laws which form the foundations of the Natural Sciences and are inseparably connected with our material and intellectual prosperity; whose geniality and enthusiasm in the pursit of his favorite studies, and whose unequaled power of presenting the results of those studies to the public in a simple and attractive form, have endeared to the hearts of this nation, and especially to us and others, who are more or less individually concerned in the pursuit of scientific truth.

Resolved, That we believe that to Prof. Agassiz and the pupils whom he influenced by his teachings and example, we largely owe the adoption of that wise liberality, exhibited by the government and by many private individuals, in matters relating to scientific exploration and research, which is so justly the pride of American citizens.

Resolved, That the visit of Prof. Agassiz to this community, his genial presence, and his address before the Academy and its friends, will always be held by us in grateful remembrance.

Resolved, That we deeply regret the bereavement of Prof. Agassiz' family and would offer them our sincere and respectful sympathy.

Resolved, That these resolutions be printed in the Academy's Proceedings, and that the Secretary be directed to forward an engrossed copy to the family of the deceased.

NOTE.

In order to complete the text of the Proceedings for the year 1873, the above fractional page is inserted; it will be repeated and the page completed with the succeeding signature, commencing 1874.

enduring fame throughout both hemispheres; whose efforts in this his adopted country have, more than those of any other individual, contributed to a widely popular appreciation of the dignity, value, and importance of scientific research, and to the necessity of incorporating in our schemes of education, instruction in those laws which form the foundations of the Natural Sciences, and are inseparably connected with our material and intellectual prosperity; whose geniality and enthusiasm in the pursuit of his favorite studies, and whose unequaled power of presenting the results of those studies to the public in a simple and attractive form, have endeared him to the hearts of this nation, and especially to us and others who are more or less individually concerned in the pursuit of scientific truth.

Resolved, That we believe that to Prof. Agassiz and the pupils whom he influenced by his teachings and example, we largely owe the adoption of that wise liberality, exhibited by the government and by many private individuals, in matters relating to scientific exploration and research, which is so justly the pride of American citizens.

Resolved, That the visit of Prof. Agassiz to this community, his genial presence, and his address before the Academy and its friends, will always be held by us in grateful remembrance.

Resolved, That we deeply regret the bereavement of Prof. Agassiz' family, and would offer them our sincere and respectful sympathy.

Resolved, That these resolutions be printed in the Academy's Proceedings, and that the Secretary be directed to forward an engrossed copy to the family of the deceased.

Annual Meeting, January 5th, 1874.

President in the chair.

Sixty-four members present.

Matthew Turner, Levi M. Kellogg, and A. P. Elfelt, were elected resident members.

Donations to the Museum: From A. Roman & Co., a large piece of coral; from W. G. W. Harford, specimens of algæ from Japan.

The President delivered his annual address, showing the progress of the Academy during the past year, and the gratifying additions to its library, museum, and membership.

The reports of the Director of the Museum, Secretary, and Librarian, were presented and accepted.

The Treasurer presented his report for the past year, of which the following is a summary: Amount received for monthly dues, life memberships, interest, and balance from the preceding year, $7,386.15; disbursements during the same year, $2,823.43, leaving a balance on hand of $4,562.72.

On motion, the report was accepted and ordered filed.

The annual election being now in order, the following gentlemen were declared elected officers of the Academy for the current year:

PRESIDENT.
GEORGE DAVIDSON.

VICE PRESIDENT.
JOHN HEWSTON, JR.

TREASURER.
ELISHA BROOKS.

CORRESPONDING SECRETARY.
R. E. C. STEARNS.

RECORDING SECRETARY.
CHAS. G. YALE.

LIBRARIAN.
DR. H. BEHR.

DIRECTOR OF THE MUSEUM.
H. G. BLOOMER.

TRUSTEES.
D. D. COLTON.
GEORGE E. GRAY.
HENRY EDWARDS.
OLIVER ELDRIDGE.
R. E. C. STEARNS.
THOMAS P. MADDEN.
DR. A. B. STOUT.

On motion, a vote of thanks was made to H. M. Newhall, for his liberality in regard to the rental of the building soon to be occupied by the Academy, on the corner of Dupont and California Streets, and for the further donation of one hundred dollars per month during the time that the Academy may continue to occupy said building.

On motion, the rules were suspended, and Henry M. Newhall was unanimously elected a life member of the Academy.

On motion, a vote of thanks was tendered to President Davidson, for the active part he had taken in the affairs of the Academy, and the manner in which he had presided at the meetings during the past year.

The Director of the Museum presented a list of the Algæ in the Academy's collection.

Regular Meeting, January 19th, 1874.

President in the chair.

Thirty members present.

George W. Smiley, and L. Livingston, were elected life members; Judge S. S. Wright, W. H. L. Barnes, Dr. A. S. Hudson, Dr. Gustave Eisen, August Drucker, Charles Schultze, Everard Stiele, E. E. Haft, and A. B. Paul, were elected resident members.

Donations to the Library: It was announced that the Academy had received from Prof. Henry, of the Smithsonian Institution, a large collection of standard works of reference, proceedings of learned societies, etc.—in all about two thousand volumes—of which a catalogue is in preparation. For this magnificent donation a special vote of thanks was tendered by the Board of Trustees, and also by the Academy.

Donations to the Museum: From E. P. Upton, of Castle Brothers, specimens of Japanese manufacture, embracing seventy-five varieties of tanned and preserved skins; *Trapa bicornis*, an edible Chinese water nut; linen cloth with fiber; sample of tea from Mount Mohea, in China, said to be the finest made, and to have been sold in this city for twenty-five dollars per pound, at wholesale; also a quantity of seeds of the tea-plant in the capsules; from E. T. Lorquin, stuffed specimens of *Pelecanus fuscus*, from the Bay of San Francisco; also, specimens of *Cupidonia cupido*, purchased in this market, probably from the Rocky Mountain region; from J. P. Dameron, specimens of lignite from Lincoln, and Mount Diablo coal; from Captain John H. Mortimer, of the ship "Isaac Webb," specimens of *Halobatis sericeus; Phyllosoma commune*, or glass crab; *Leptocephalus*, or ribbon fish; *Litiopa bombyx*, with fiber and ova attached; *Fucus navalis*, or Sargasso weed, entangled with byssus threads spun by the *Litiopa bombyx;* three specimens of birds caught at sea; a flying fish; *Salpa pinnata; Velel-*

la, and various marine specimens; from L. H. Thompson, Buff Cochin chickens, preserved in alcohol, and remarkable for having four legs.

Mr. Chase read a paper on the auriferous sands of Gold Bluff, illustrating it by drawings and sections of the locality, and arriving at the following conclusions:

First, that the gold evidently comes from the bluffs. This no one can doubt after once viewing them. Secondly, that after caves, the gold obtained is much coarser in character. Thirdly, that it is only after a continued succession of swells that cut the beach at an angle, that the rich sands are found. When the surf breaks squarely on, let the storm be ever so heavy, it simply loads the beaches with gravel. Fourthly, that no one witnessing the power of the surf, breaking as it does, with no rocky headlands, points, or rocks to deaden it, can doubt that it must have an immense grinding force. Hence, Mr. Chase believes that the gold follows the first two or three lines of breakers, and will never be found in paying quantities beyond.

Mr. Chase sent Prof. J. D. Dana specimens of the sands of Gold Bluff, and that gentleman, in speaking of the sands, says: "The red grains in the sand are garnets. It is altogether probable that the deposit dates partly from the close of the glacial era; that is, the time of melting of the ice in the early part of the Champlain period, when floods and gravel depositions were the order of the day, and partly from the later part of the Champlain period, when the floods were but partially abated, yet the depositions were more quiet."

Mr. W. H. Dall presented the following papers:

Catalogue of Shells from Bering Strait and the adjacent portions of the Arctic Ocean, with descriptions of three new species.*

BY W. H. DALL, U. S. COAST SURVEY.

Having had occasion to examine several collections of shells brought down by whalers from the Arctic Ocean in the autumn of 1873, I was struck by the fact that there does not appear to be any catalogue of the species of that vicinity. Indeed, the region has been visited by but few collectors, and the species have been commonly described among a crowd of others from all sorts of localities. The collectors upon whose localities dependence can be placed are rare, and mostly of modern date. I have therefore prepared this catalogue as a kind of preliminary basis for a better one. The authorities are chiefly as follows: Gray and Sowerby in the voyage of the *Blossom*, Captain F. Beechey; Gould on the shells collected by the late Dr. Wm. Stimpson of the North Pa-

*Published in advance, February 26th, 1874.

Figure 1.

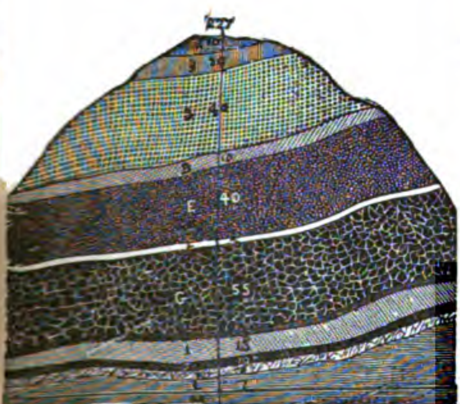

Figure 2.

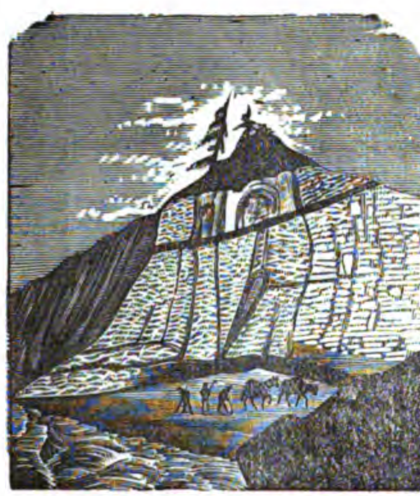

Figure 3.

FIGURE 1.—The beach at Gold Bluff, looking south.

FIGURE 2.—Section of the Bluff. A, loam, ten feet; B, yellow clay, twenty feet; C, yellow gravel, ten feet; D, brownish sandstone, ten feet; E, red and yellow gravel, forty feet; F, blue sandstone, five feet, containing numerous fragments of wood, partially transformed into lignite; G, coarse red and yellow gravel, fifty-five feet; H, very fine blue gravel, five feet; I, indurated sand, fifteen feet; J, gravel, stained red with oxide of iron, ten feet; K, blue sandstone with lignite, five feet; L, sandstone without lignite, five feet; M, gravelly beach, seven feet to low water mark. Total, about 227 feet.

FIGURE 3.—View of the mine, where the black sand is collected on the beach and transported to the works on the backs of mules.

These figures are from drawings by Mr. Chase.

cific Exploring Expedition under Captain (now Admiral) John Rodgers; Dr. P. P. Carpenter's Reports to the British Association; my own collections from Plover Bay, and Norton Sound, and southerly, from 1865 to 1873; collections from Cape Espenberg and Grantley Harbor by Captain E. E. Smith, and from Icy Cape by Captain T. W. Williams, in 1873. A few other species known to be found in that region have been added from various sources. Synonymy, in general, has been waived, except for the purpose of referring to a figure. The region is probably a rich one, especially in forms of the *Buccinoid* and *Chrysodomoid* types, and it is to be hoped that it may be more thoroughly explored before long. The large collections of species made by Dr. Stimpson in this region were lost in the Chicago fire, and contained many unpublished forms. It is, therefore, particularly desirable that more material should be obtained, and no one is better able to contribute to our knowledge in this respect than our hardy whalers. Doubtfully identified species and those which may be synonymous with others, are marked with an asterisk. Those species which may have been erroneously attributed to the region referred to, have in general been omitted. St.—Stimpson; W.—Williams; B.—Beechey; S.—Smith; D.—Dall; collectors.

MOLLUSCOIDEA.

Class Tunicata.

1. *Chelysoma Macleayanum*, Brod.; Arctic Ocean; B.

2. *Cynthia pyriformis*, Lin.; Plover Bay; Avatcha Bay; south to the Aleutians; D.

3. *Boltenia Beringi*, Dall; Bering Sea; Pribiloff Islands; D. There are also a large number of species of tunicates in my own collection not yet identified.

Class Brachiopoda.

4. *Rhynchonella psittacea*, Lin. (var.?); Seniavine Str., St.; Plover Bay; Norton Sound, D.; south to Sitka, D.

5. *Terebratella frontalis*, Midd.; Ochotsk Sea; Attu Id. Aleutians, D. (Probably an arctic species).

MOLLUSCA VERA.

Class Acephala.

6. *Saxicava pholadis*, Lin.; Plover Bay; Norton Sound; universal in colder water; D.

7. *Mya præcisa*, Gld.; Plover Bay; Avatcha Bay; Norton Sound; south to Sitka; D.

8. *Mya truncata*, Lin.; Cape Espenberg, S.; Plover Bay; Norton Sound; south to Sitka, D.

9. *Cyrtodaria siliqua*, Blainv.; Plover Bay; Norton Sound; south to Aleutians; D.

10. *Corbula gibbosa*, Brod.; Icy Cape (?); B.

11. *Lyonsia norvegica*, Chemn.; Arctic Ocean; S.

12. *Lyonsia flabellata*, * Gld.; Arctic Ocean; S.

13. *Siliqua media*, Dall ex Gray; Cape Espenberg, S.; Norton Sound, D. (*S. borealis*, Conr.; and *costata*, Midd. non Say, pars.).

14. *Tellina alternidentata*, Brod.; Icy Cape, B.; Cape Espenberg, S Avatcha Bay; Aleutians, D.; south to Sakalin Id., Schrenck. (*Tl. utea*; Gray; *Guilfordia*, Gray; *venulosa*, Schr.).

15. *Macoma nasuta*, Conr.; Plover Bay, D.; south to Monterey, Cal.; D.

16. *Macoma edentula*, Brod.; Bering Strait, B.; Aleutians, D.; south to Oregon, D.

17. *Macoma inconspicua*, Brod.; Icy Cape, W. B.; Grantley Harbor, S.; Plover Bay; Norton Sound; Aleutians, D.

18. *Macoma proxima*, Brown; Arctic Ocean, B.; Norton Sound; Aleutians, D.

19. *Standella falcata*, Gld.; Cape Espenberg, S.; Aleutians; and south to California; D.

20. *Liocyma fluctuosa*, Dall ex Gld.; Ochotsk Sea, Midd.; Aleutians, D.

21. *Liocyma Beckii*, Dall; Plover Bay, D.

22. *Liocyma viridis*, Dall; Arctic Ocean, St.

23. *Liocyma arctica*, Rve.; Arctic Ocean (ubi ?).

24. *Astarte semisulcata*, Leach (teste Stm.); Plover Bay; Norton Sound; Aleutians; Avatcha Bay, D.; Cape Espenberg, S.; Icy Cape, B.; (*A. lactea*, Brod.; *crassidens*, Brod., Voy. Blos.).

25. *Astarte Banksii*, Gray; Norton Sound; Plover Bay; Aleutians, D.; Arctic Ocean, B.

26. *Astarte striata*, Gray; Arctic Ocean, B.

27. *Venericardia borealis*, Conr.; Plover Bay; Norton Sound; Aleutians, D.; Arctic Ocean, St.; south to Catalina Island, Cal., Cooper.

28. *Cardium islandicum*, Chemn.; Cape Espenberg, S.; Norton Sound; Aleutians; south to Sitka, D.

29. *Cardium boreale*, * Brod.; Icy Cape, B.

30. *Serripes grönlandicum*, Chemn.; Icy Cape, B. W.; Cape Espenberg; Grantley Harbor, S.; Plover Bay; Norton Sound; Aleutians; south to Oregon, D.

31. *Serripes Laperousii*, Desh.; Plover Bay; Avatcha Bay; Aleutians; Kadiak; Sitka, D.

32. *Lucina borealis*, Lin.; Aleutians; Sitka; Catalina Id., D.; probably arctic also.

33. *Turtonia occidentalis*, Dall; Plover Bay, D.

34. *Mytilus edulis*, Lin.; Cape Espenberg, S.; mouth of the Mackenzie River; McFarlane (whole Arctic Ocean probably).

35. *Modiola modiolus*, Lin.; Plover Bay; Aleutians; south to Monterey, Cal.; D.

36. *Modiolaria lævigata*, Gray; Plover Bay; Norton Sound; Aleutians, D.; south to Oregon.
37. *Modiolaria marmorata*,* Forbes; Arctic Ocean.
38. *Modiolaria nigra*,* Gray; Arctic Ocean, St.
39. *Modiolaria corrugata*, Seniavine Strait, St.
40. *Yoldia myalis*, Couth.; Seniavine Strait, St.
41. *Yoldia limatula*, J. Sby.; Arctic Ocean, St.
42. *Yoldia truncata* (Cpr.); Norton Sound, D.
43. *Yoldia siliqua* (Cpr.), Norton Sound, D.
44. *Yoldia intermedia* (Cpr.), Norton Sound, D.
45. *Leda arctica*, Brod.; Seniavine Strait, St. (*L. lanceolata*, J. Sby.).
46. *Leda minuta* (Gld.); Bering Strait; Seniavine Strait, St.
47. *Nucula tenuis*, Mont.; Seniavine Strait, St.; Plover Bay; Norton Sound; Aleutians; ? south to Sitka, D.
48. *Nucula expansa*, Rve.; Plover Bay; Aleutians; Sitka, D.
49. *Pecten islandicus*,* Chemn.; Arctic Ocean, St.

Class Gasteropoda.

50. *Cylichna triticea*, Couth.; Seniavine Strait, St.
51. *Chiton vestitus*, Sby.; Seniavine Strait, St.
52. *Chiton albus*, Lin.; Seniavine Strait, St.; Plover Bay; Norton Sound; Aleutians; Sitka; Catalina Id., D.
53. *Chiton lineatus*, Wood; Plover Bay; Norton Sound; Pribiloff Islds.; Aleutians; Kadiak; Sitka; Monterey, D.
54. *Collisella testudinalis*, Müll.; Plover Bay; Norton Sound; in deep water south to Sitka, D.
55. *Cryptobranchia concentrica*, Dall ex Midd.; Bering Sea, D.
56. *Cryptobranchia alba*, Dall; Plover Bay, D.; Seniavine Strait, St.
57. *Margarita umbilicalis*,* Brod. "Northern Ocean." (ubi?)
58. *Margarita striata*, Leach; Seniavine Strait, St.
59. *Margarita argentata*, Gld.; Seniavine Strait, St.
60. *Margarita ianthina*,* Gld.; Arctic Ocean, St.
61. *Margarita albula*,* Gld.; Arctic Ocean, St.
62. *Margarita helicina*, Mont.; Plover Bay; Norton Sound; Aleutians; Sitka, D.
63. *Margarita obscura*, Couth.; Cape Espenberg, S.; Aleutians; Norton Sound; Sitka, D.
64. *Crepidula grandis*, Midd.; Plover Bay; Norton Sound; Aleutians, D. (not *princeps* of Conr. fossil).
65. *Mesalia polaris*, Beck; Cape Espenberg, S.; Plover Bay, D.
66. *Mesalia lactea*, Möll.; Plover Bay, D.
67. *Mesalia reticulata*,* Migh.; Seniavine Strait, St.
68. *Litorina tenebrosa*, var.? Plover Bay; Norton Sound; Aleutians, D.
69. *Litorina squalida*,* Gray; Icy Cape, B.

70. *Lacuna vincta*, Mont.; Plover Bay; Norton Sound; Aleutians; Sitka, D.

71. *Admete viridula*, Couth; Seniavine Strait; St. Aleutians; D.

72. *Admete arctica*, * Midd.; Arctic Ocean; Seniavine Strait; St.

73. *Trichotropis cancellatus*, Hinds; Norton Sound; Aleutians; Sitka; D.

74. *Trichotropis insignis;* Midd.; Seniavine Strait; St. Plover Bay; Norton Sound; Aleutians; D.

75. *Trichotropis borealis*, Lin.; Melville Ids.; Icy Cape; B.; Plover Bay; Aleutians; D.

76. *Trichotropis bicarinatus*, Sby.; Cape Lisburne; Icy Cape; B.; Plover Bay; D.

77. *Trichotropis bicarinatus*, var. *alta*, Dall; Plover Bay; D.

78. *Trichotropis bicarinatus*, var. *spectabilis*, Dall; Seniavine Strait; St.

79. *Iphinoë coronata*, Gld.; Seniavine Strait; St.

80. *Bela lævigata*, Dall; Norton Sound; D.

81. *Bela tenuilirata*, Dall, Norton Sound; Aleutians; D.

82. *Bela turricula*, Mont.; Seniavine Strait; St.

83. *Bela rufa*, Mont.; Seniavine Strait; St.

84. *Bela decussata*, Couth; Seniavine Strait; Avatcha Bay; St.

85. *Bela harpularia*, Couth; Seniavine Strait; St.

86. *Odostomia Beringi*, Dall; Norton Sound; D.

87. *Scalaria grönlandica*, Chemn.; Cape Espenberg; S.; Seniavine Strait; St.

88. *Natica clausa*, Brod.; Plover Bay; Aleutians; D.

89. *Natica russa*, Gld.; Plover Bay; Norton Sound; Aleutians; De.; Arctic Ocean; St.

90. *Lunatia septentrionalis*, * Beck.; Seniavine Strait; St.

91. *Lunatia pallida*, Brod. & Sby.; Cape Espenberg; S.; Icy Cape; B.; Plover Bay; Norton Sound; Aleutians; D.

92. *Amauropsis purpurea*, Dall; Grantley Harbor; S.; Icy Cape; W.; Norton Sound; Plover Bay; D.

93. *Velutina haliotoidea*, Fabr.; Plover Bay; Norton Sound; Aleutians; Sitka; Monterey, Cal.; D.; Seniavine Strait, St.; Catalina Id., Cal.; Cooper.

94. *Velutina zonata*, Gld.; Seniavine Strait; St.

95. *Velutina cryptospira*, Midd.; Norton Sound; Pribiloff Ids.; Aleutians; Sitka; D.

96. *Velutina coriacea*, Pall.; Cape Lisburne Bay; B.

97. *Purpura canaliculata*, Ducl.; Plover Bay; Norton Sound; Aleutians; Sitka; D.

98. *Buccinum ciliatum;* Icy Cape, W.; Cape Espenberg; S.

99. *Buccinum tortuosum*, Rve.; Seniavine Strait; St.

100. *Buccinum polare*, Gray; Icy Cape; B.; Plover Bay; Norton Sound; D.

101. *Buccinum tenue*, Gray; Icy Cape; B.; Plover Bay; D.

102. *Buccinum angulosum*, * Gray; Icy Cape; B. (*Stimpsoni*, Gld.; Bering Strait; St.)

103. ** *Buccinum glaciale*, Stm.; Icy Cape; W.; Seniavine Strait; St.; Plover Bay; Norton Sound; Aleutians; Kadiak; D..

104. *Buccinum tenebrosum*, Hancock; Arctic Ocean; B. (*borealis*, B. & S.; same locality).

105. *Buccinum Fischerianum*, Dall; Pribiloff Ids.; D. (probably also Arctic).

106. *Buccinum Mœrchianum*, Dall ex Fischer; Norton Sound; Aleutians; Sitka; Kadiak; D.; *B. cyaneum*, Hanc. var.

107. *Buccinopsis canaliculata*, Dall, n. s.; Cape Espenberg; S.

108. *Volutoharpa ampullacea*, Midd.; Seniavine Strait; St.; Plover Bay; Aleutians; Kadiak; Sitka; D.

109. *Chrysodomus liratus*, Mart., var. *tornatus*, Gld.; Cape Espenberg; S.

110. *Chrysodomus fornicatus*, Gmel.; Icy Cape; W. B.; Seniavine Strait; St.; Cape Espenberg; S.; Mouth of the Mackenzie River; McFarlane; Plover Bay; Norton Sound; D. (*deforme*, Rve.)

111. *Chrysodomus glacialis*,* Gray; "Arctic Ocean."

112. *Chrysodomus Schantaricus*,* Midd.; Seniavine Strait; St.; Ochotsk Sea; Midd.

113. *Chrysodomus islandicus*, Chemn.; Seniavine Strait; St.

114. *Chrysodomus terebralis*, Gld.; Icy Cape; W.; Cape Espenberg; S.; Aleutians; D.

115. *Heliotropis harpa*, Dall, ex Mœrch; Icy Cape; W.; Shumagins; Unalashka; D.

116. *Volutopsis Beringi*, Midd.; Icy Cape; W.; Aleutians; D. (Captain William's specimens were very strongly shouldered, short spired, heavy, and large).

117. *Volutopsis attenuata*, Dall, n. s.; Cape Espenberg; S.; Cook's Inlet; D.

118. *Trophon clathratus*, Lin.; Seniavine Strait; St.

119. *Trophon multicostatus*, Esch.; Norton Sound; Plover Bay; Aleutians; Sitka; D. (*lamellosus*, Gray ?).

120. *Trophon lamellosus*, * Gray; Icy Cape; B.

121. *Trophon Orpheus*, Gld.; Plover Bay; D.

Buccinopsis canaliculata, n. s.

Shell solid, livid white, covered with a strong, dark brown pilose epidermis; whorls moderately rounded; suture deeply channelled; surface of the whorls covered with fine, spiral thread-like ridges, with still finer ones intervening between them, lightly decussated by the fine, but distinct lines of growth, to which the epidermis especially adheres; the coarser ridges are about seven in number, between the posterior end of the aperture and the edge of the suture

** This species is exceedingly variable in every respect. *B. angulosum*, Gray, is probably an extreme variety of it; *B. Rodgersi*, of Gld., *Stimpsoni*, Gld., *carinatum*, *Marchianum* and *Rombergi*, of Dunker, and *angulosum* and *rutilum*, of Mœrch, besides some of Middendorf's species which I cannot now specify, are all forms of this protean species.

behind it. Whorls 5½, aperture half as long as the shell; internally polished; outer edge somewhat thickened; inner lip callous; collumella strongly twisted; canal short, rather wide. Lon. 1.33 inches, lat. 0.75 inches; defl. 55°. This species is much less inflated, and proportionally longer than *B. Dalei*, Sby., which is nearly smooth, and has not the deeply channelled suture. *S. striata*, Jeffreys, (if this be a true *Buccinopsis*, which I doubt) has a straight columella, and proportionally larger body whorl; the present species is a neater and more fusiform shell, with much finer sculpture.

Captain Smith obtained but one tolerably fresh adult specimen, of this interesting shell, on the beach at Cape Espenberg.

Volutopsis attenuata, n. s.

Shell solid, pinkish white, much attenuated before and behind; spire one-quarter shorter than the aperture. Whorls six, apex mammillated. Posterior surface of the whorls flattened toward the suture, where they are somewhat wrinkled and appressed. Surface of the whorls completely covered with fine, even, spiral lines. Aperture long and narrow, a thickened callus on the inner lip, and the outer lip slightly reflected. Canal long, nearly straight, rather narrow. Lon. shell, 2.33 inches, of aperture 1.4 inches, lat. shell 1.0, of aperture 0.5 inches; defl. 40°.

This very interesting species is at once distinguished from any of the described species, by the spiral sculpture, and otherwise by its elongated and slender form. *V. regularis*, Dall, from the Aleutians, is a much more robust shell, and of the same color, but quite smooth. One specimen, in good order, was all that Captain Smith obtained. It has also been obtained at Cook's Inlet.

85a. *Pleurotoma vinosa*, n. s.

This shell is closely allied to *P.* (*Surcula*) *perversa*, of Gabb, from the Straits of Fuca and Catalina Island, but differs in the following particulars: *P. perversa* has a light olivaceous epidermis, which gives a livid appearance to the light reddish brown of the whorls outside; and a broad, white band, with ill-defined edges, passes round the periphery of the shell, just covered by the suture in the upper whorls. The columella, end of the canal, and tip of the shell, are also white. The present form is of a uniform deep winebrown, or claret color; is shorter and much less slender, with a shorter canal and proportionately much larger aperture. Both shells are reversed, and covered with fine, somewhat irregular spiral lines, not mentioned by Gabb in his diagnosis. My specimens were obtained in Kyska Harbor, Great Kyska Island, Aleutians. My largest shell has nine whorls, and is a quarter of an inch shorter, and one-fifth of an inch broader, than a specimen of *P. perversa* of exactly the same number of whorls. It probably belongs to the Aleutian fauna, but may go northward to the Straits.

On New Parasitic Crustacea, from the N. W. Coast of America.*

BY W. H. DALL, U. S. COAST SURVEY.

More than a year ago, I submitted to the Academy descriptions of three new species of Cyami, from as many species of Pacific Cetacea. On examination of a small collection of parasites, in the collection of the Academy, (presented by Captain C. M. Scammon, and reported to have been procured from a Pacific Right Whale, near the Island of Kadiak, Alaska, in 1873) I find that it contains two species, both apparently undescribed. It is to be presumed that each species of whale has parasites peculiar to itself, and those who have the opportunity of collecting these interesting animals should lose no opportunity of examining the rarer cetacea, and should preserve the parasites of each species carefully by themselves. As there are many species from which no parasites have yet been collected, there are doubtless as many kinds of Cyami which are still unknown.

The species described on pp. 281-3, Vol. IV of the Academy's Proceedings, have been well figured on plate X of Captain Scammon's Marine Mammals of the N. W. Coast of America, and, in default of a figure of the present species, I have preferred to give a comparative diagnosis, by which they may be more readily distinguished from the figured and other described species.

Cyamus tentator, n. s.

Species in size and general form resembling *C. Scammoni* Dall, (Scammon, loc. cit. pl. X, figure 2) of a pale, waxy yellow, with the tips of the branchiæ purplish. It differs from *C. Scammoni* in the following particulars: Head proportionately smaller, not constricted behind the eyes, terminating in a point in the median line behind, which point overlaps a median channel in the body segment. Second pair of antennæ proportionately much longer, equaling twice the length of the head. Second pair of hands, with two sharp, spike-like tubercles in place of the two rather short and blunt tubercles of *C. Scammoni*. Hands otherwise very similar. Second segment with a broad channel in the median line, widening backward from the head, and rather shallow. Third segment not rounded at its outer ends, but furnished with very prominent knobs, at the anterior and posterior corners on each side. The outer edges of the fourth segment are also knobbed before and behind, but the anterior knobs are less prominent. The branchiæ are not spirally twisted, but are straight, laterally extended cylinders, nearly as long as the width of the segment to which they are attached. There are two pairs on each side of the third and fourth segments in the male. The upper pair on each side are not of equal length, as in *C. Scammoni*, but the inferior branchia of this pair is much shorter than the other; both are straight or slightly curved upward and forward. The lower pair exist only in the males, they are very slender, and filiform, and quite short.

*Published in advance, March 3d, 1874.

In the female they seem to be changed into pouches for the development of the ova. Posterior part of the body as in *C. Scammoni*, but there are no serrations on the anterior edge of the seventh segment. Length of largest specimen, 0.8 inches. Domicile on *Balæna Siebodii*, Gray; North Pacific Ocean.

This is readily distinguished from *C. mysticeti* Dall, by its spiked "hands" and knobby branchial segments; and from *C. Scammoni* by its straight unequal branchiæ, long antennæ, knobs, and the shape of the head.

Cyamus gracilis, n. s.

This species is of a pale, waxen yellow, of elongated and slender form, and small and slender limbs. It more nearly resembles *C. suffusus* Dall, (Scammon loc. cit. pl. X, figure 3) than any of the other described species. It differs from that species in the following particulars: It is smaller, the largest specimen measuring only 0.5 of an inch in length. It wants the purple color, and is more compact and solid. The second pair of antennæ are much shorter, being only equal to the first segment and half of the next segment of the corresponding members in *C. suffusus*. The branchiæ, though similar, are proportionally one-third shorter. The posterior limbs are shorter and much more weak and slender than in *C. suffusus*. The first pair of "hands" are slenderly pyriform, instead of quadrate. The second pair are simple, without the tubercles between the articulation of the limb and the "finger;" or, at most, in the largest specimens, the termination of the hand under the articulation of the hook, or finger, is slightly produced into a point. The head is shorter, sub-triangular instead of elongated. Lastly, the segments of the body are more or less closely appressed against each other before and behind, instead of being laterally attenuated, and separated as in *suffusus*. They are also proportionately less wide from side to side than in *suffusus*. Habitat, with the last.

The prominent features of this species are its slender and compact form, short antennæ, and weak and inconspicuous posterior limbs.

Captain T. W. Williams brought down from the Arctic Ocean, in 1873, some parasites from the walrus, which he presented to the Academy. These parasites are of a very dark brown color, almost perfectly round in shape, with an indistinctly segmented abdomen, somewhat roughened with short hairs; three pairs of short, bristly legs, a distinct but small throat, and very small and short head. There is one pair of short, stout antennæ, with four joints; the mouth is suctorial. There are no other appendages to the abdomen or head. The want of books of reference prevents my being able to refer these creatures to their proper generic position; and it would be, in any case, inadvisable to describe them as new, as parasites from the walrus of the North Sea have been recently described by a Swedish naturalist, and they may be identical with the present form.

Mr. Stearns, reporting for the Publication Committee, spoke of the large amount of work accomplished by the Committee during the past year, and stated that the Proceedings of the Academy, for 1873, would be ready for distribution at the next meeting.

On motion of Mr. Dall, a vote of thanks to Mr. Stearns was adopted, in consideration of the large amount of labor and time which he had personally devoted to the publications, during the year.

The President announced the following appointments, made by the Board of Trustees at their last meeting:

CURATORS.

General Zoölogy	GEORGE HEWSTON, M. D.
Ichthyology	W. H. DALL
Conchology	W. G. W. HARFORD
Ornithology	WILLIAM BLUNT
Entomology	HENRY EDWARDS
Palæontology	W. A. GOODYEAR
Mineralogy	THEO. A. BLAKE

COMMITTEE ON PUBLICATIONS.

GEORGE DAVIDSON. CHARLES G. YALE.
R. E. C. STEARNS. HENRY EDWARDS.
ALBERT KELLOGG, M. D.

COMMITTEE ON FOREIGN PUBLICATIONS.

A. B. STOUT, M. D. J. F. LEWIS.
H. N. BOLANDER. H. BEHR, M. D.
EMILE DURAND. J. M. SMYTHE.

The President also stated that the Academy, having effected a lease of the church on the corner of California and Dupont Streets, would hold their next meeting in their new quarters.

Regular Meeting, February 2nd, 1874.

President in the chair.

Forty-eight members present.

A. S. Hallidie, A. D. Smith, and W. M. Wherry, were elected resident members, and Albert H. Harris, life member.

Donations to the Library: Overland Monthly, February, 1874; also California Horticulturist, for January, 1874, from J. H. Carmany & Co. Ameri-

can Naturalist, January, 1874. Monatsbericht der Konig. Preuss. Akad. der Wissenschaften zu Berlin, Sept., Oct., 1873. American Journal of Science and Art, Jan., 1874. Catalogue Library Co., of Philadelphia, Jan., 1874. Proceedings Academy Natural Sciences of Philadelphia, pp. 361–408, 1873. Ueber eine Vogelsammlung aus Ostasien von O. Finsch, und P. Conrad, pamphlet, 8vo., 1873, from Authors. Engineering and Mining Journal, Jan. 10th and 17th, 1874. Biennial Report, Regents of the University of California. Catalogue of the Land Mollusca of New Zealand, etc., Wellington, 1873. Critical List of the Mollusca of New Zealand contained in European collections, etc., by E. Von Martens, Wellington, 1873; also, Catalogue of the Tertiary Mollusca and Echinodermata of New Zealand, in the Colonial Museum, by F. W. Hutton, Wellington, 1873, Dr. James Hector, Director, etc. American Chemist, Philadelphia, Jan., 1874. Ueber das Funkeln und Aufblitzen des Mittelmeeres, etc., pamphlet, 4to, Berlin, 1873; also, Das unsichelbar wirkende Leben der Nordpolarzone, etc., pamphlet, 8vo., Berlin, both from Author, C. G. Ehrenberg. Bulletin of the U. S. Geological and Geographical Survey of the Territories, No. 1, Washington, 1874, from Department of Interior. Bulletin of the Essex Institute, Vol. V., Nos. 9 and 10. Engineering and Mining Journal, Jan., 24th, 1874.

By purchase: Nature, Jan. 1st, 1874. Journal of Botany, London, Jan., 1874. Annalen der Physik und Chemie, Leipzig, (No. 9) 1873. Archiv. für Naturgeschichte, Berlin, 1873–4. Astronomical Register, Jan., 1874. Quarterly Journal of Microscopical Science, London, Jan., 1874. Annals and Magazine of Natural History, Jan. 1874.

Donations to the Museum: Mr. Henry G. Hanks presented specimens of borax from the crude to the finished product. There were nine different samples in this donation, as follows: Bi-borate of soda, crude, from Nevada; bi-borate of soda, refined by Pacific Chemical Co.; bi-borate of soda, native, from Borax Lake; tincal, or crude borax, from Slate Range, Cal.; tincal from Thibet Lakes; crypto-morphite (borate of lime) from Oregon; ulexite (borate of lime) from Nevada; individual borax crystals, from Pacific Chemical Co.; residual crystals from vats.

Mr. I. C. Woods presented specimens of *Limnoria*, a species of wood-eating crustacean, from piles in the wharves of the bay. They were taken from near high water-mark when the tide was out, and lived twenty-four hours in the wood after being removed from the piles. A sample of wood accompanied them to show how they penetrated it.

Mr. P. S. Shoaff presented ten samples of ores from mines in Humboldt County, Nevada.

Mr. S. G. George, of Portersville, Montana, sent to the Academy the head and horns of a Rocky Mountain Goat. It has a musk sack behind each horn, and resembles the Thibet Goat, the wool of which is so highly prized. Several of the animals have been captured alive, and one will shortly be exhibited in this city. It is designed to cross the species with the Angora Goat, in expectation of producing a valuable hybrid.

Capt. J. H. Mortimer presented marine invertebrates (*crustacea* and *salpæ*) from the Atlantic Ocean. Lat. 30° N., and Lon. 55° W. G.

Dr. Blake exhibited the cast of a skull that had been taken out from the Ophir mine, on the Comstock Lode, Nevada. The skull had been brought up with some dirt from the 400-foot level; but it is probable that it had been carried down in dirt from a neighboring ravine, which, at an earlier period, had been used to stop some of the former workings. But, independently of its history, the skull presents some features which render it extremely interesting, from an ethnological point of view. The principal of these, were the presence of a large interparietal bone, extending almost to the occipital protuberance, the heavy superciliary ridges, the very low forehead, and great development of the posterior portion of the skull, the peculiar position of the socket for the articulation of the lower jaw, and the great development of the processes for the attachment of muscles. Unfortunately the whole of the palatal portion below the orbits and a large part of the base of the skull were missing; but from what remained, the Doctor considered that it presented a form more removed from that of any existing race of human beings than that of any skull that had heretofore been found. It was submitted to Dr. Blake by Professor Whitney. The original skull was covered with a thin metallic scale deposited by water, and it had been somewhat broken by the pick-axe in being excavated.

Dr. Blake stated in reference to a paper read by him at a former meeting, on the "Nickeliferous sands of Frazer River," that having ascertained from Prof. Wolcott Gibbs, that the mineral he obtained from Frazer River sands, and described as magnetic oxide of nickel, had never before been discovered, he would propose for it the name of "Frazerite."

At a meeting of the Academy in November last, photographs of hieroglyphics, cut in wood, and found on Easter Island, were received from Mr. Thomas Croft, of Papeite, Tahiti. From vague traditions among the natives, they were supposed to represent the written language of some pre-historic nation. The stone idols, and other relics found there, indicate that the present population is lower in the scale than its predecessors. In the letter accompanying the hieroglyphics, Mr. Croft stated, from the best information he could obtain, that none except the priests, and a chosen few, could decipher these strange characters. A letter was now read by the President from Mr. Croft, in which he stated that he had found a native of the island who could read them, and who was going to teach him the language, so that he will shortly be able to translate them. Mr. Croft thinks that he has discovered the relics of a Malayan empire, which extended over that part of the world at some former period.

Regular Meeting, February 16th, 1874.

President in the chair.

Forty-nine members present.

George W. Beaver, George Oulton, and G. Niebaum, were elected life members. Dr. J. C. Moore, John C. Merrill, Carlton Newman, Thos. B. Bishop, Frederick Mason, John R. Sharpstein, J. E. Squire, H. F. Cooper, Emanuel Newman, F. C. DuBrutz, and James S. Gillam, were elected resident members.

Donations to the Library: American Journal of Science and Arts, Feb., 1874. Dreiunddreissigste Versammlung, am 20 Dec., 1873. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Dec., 1873. American Chemist, Jan., 1874. Annals and Magazine of Natural History, Jan., 1874. Annalen der Physik und Chemie, Band VI, No. 10, Leipzig, 1873. Annals of the Lyceum of Nat. History of New York, Vol. X, Nos. 6, 7, 8, 9, 10, 11, 1872-3. American Naturalist, Vol. VIII, No. 2, Feb., 1874. Proceedings of the Boston Society of Natural History, Vol. XVI, Part 1, May, June, 1873. Mittheil-

ungen der Deutschen Gesellschaft für Natur und Völkerkunde Ostasiens, 3tes, Heft, Yokohama, Sept., 1873. Proceedings American Academy of Arts and Sciences, Vol. VIII, May, 1868–73. The Engineering and Mining Journal, Vol. XVII, Nos. 5 and 6. Nature, Vol. IX, Nos. 220, 221.

Donations to the Museum: From W. H. Dall, large collection of Fossils of the post-pliocene period, from Esmeralda, Equador, collected by Captain A. R. Hodgkins, of the schooner "Urania"; from Prof. Davidson, a crustacean from the Island of San Miguel; from Captain E. E. Smith, specimens of Coal from the Arctic coast, near Cape Lisburne. The coal was observed in that locality for a distance of thirty to forty miles, and crops out in veins of great thickness; from Mrs. James McEwen, an object supposed to be a petrifaction, obtained on the Poso Caliente Rancho, Sonoma county, in a portion known as the Indian Garden.

The following paper was read by the President:

On Improvements in the Sextant.

BY GEORGE DAVIDSON.

The sextant is the most universal of instruments in the hands of the geographer, navigator and astronomer, because it alone is available at sea as well as on land. To the navigator it is invaluable; and in the special work of hydrography along a coast line, where the position of the boat or vessel is generally determined by observing from the boat, the sextant is the only instrument of precision in use; and yet in its present forms, it has certain deficiencies which prevent its universality of application. It fails to measure the angles between one hundred and forty and one hundred and eighty degrees; and the hydrographers of all countries have studied to remedy this defect with only partial success.

M. Daussy, the French hydrographer, measurably solved the problem by a device as simple in construction and beautiful in theory as it is difficult in practice. By means of a second horizon glass, he added, as it were, a constant angle of about ninety degrees to that measured by the index and horizon glasses, and thus obtained any angle from naught to one hundred and eighty degrees. In observing large angles he reflects both objects, which increases the difficulty of manipulation by the observer even when on land, with well defined objects; but when the observer is in a boat, disturbed by the waves, and both objects indistinct, it is next to impossible to see them; and certainly not with any degree of quickness, which such operations especially demand. Daussy's instrument has not come into practical use.

Pistor & Martins, of Berlin, have also partially solved the same problem with the prismatic sextant bearing their name. This instrument will measure

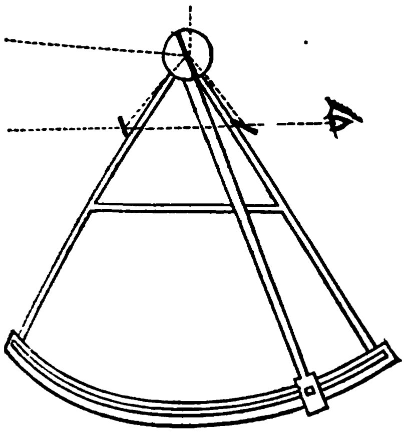

Figure 1.

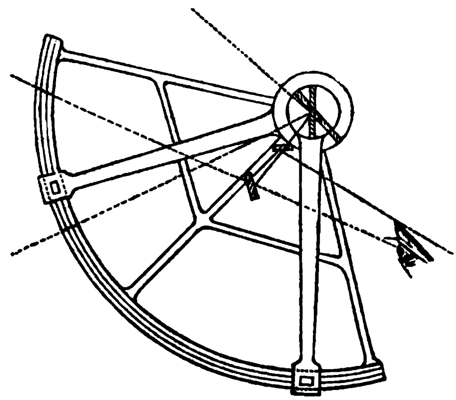

Figure 2

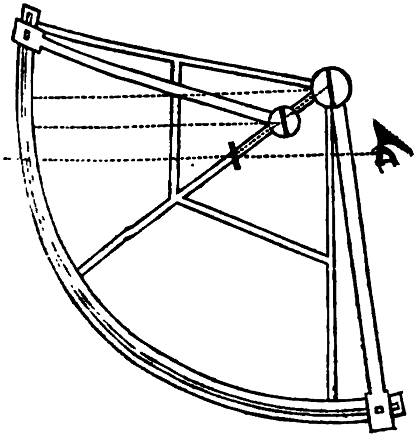

Figure 3.

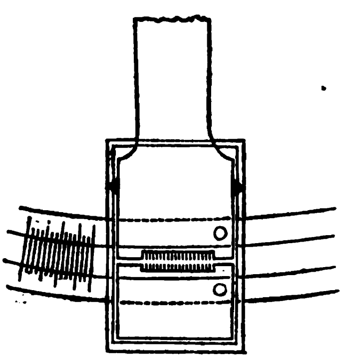

Figure 4.

Diagrams Illustrating T. J. Lowry's Improvements on the Sextant.

any angle from naught to one hundred and eighty degrees, while reflecting but one object; but in measuring the angles from about one hundred and forty to one hundred and eighty degrees, the sextant must be inverted, and the manipulation is therefore embarrassing. Their sextant is too heavy for practical use, and has not been largely adopted.

The improvements to be referred to are very important, making the sextant better adapted to hydrographic work than it has heretofore been. Mr. Lowry has solved the problems very ingeniously, and I have had models made to exhibit their practical application. In studying the subject, several other problems which occur to the practical hydrographer have been very well solved. In the work of the U. S. Coast Survey, and in the hydrographic surveys conducted by the navies of all countries, demands daily arise for such instrumental aid to solve these problems; and it is believed that most of these devices of Mr. Lowry are novel. Very few can thoroughly appreciate their value, unless they be practical hydrographers.

Mr. Lowry has given the following statement of the requirements of the hydrographer in his work, and the solutions of them:

Problem I. To measure with a sextant, any angle from naught degrees to one hundred and eighty degrees, without inverting the instrument, and while reflecting but one object.

This may be solved in the following manner: The front and back faces of index glass (of ordinary sextant) are made reflectors, and a second horizon glass placed on the line of sight, (behind the index glass) and at such an angle as to reflect the rays, which are reflected first from the back face of the index glass, parallel to the line of sight. Fig. 1 illustrates this form.

We here have an arc of only sixty degrees, graduated as usual from naught degrees to one hundred and twenty degrees, with a second reading of the same arc, commencing at naught degrees as one hundred and twenty degrees, and numbered to two hundred and forty degrees at one hundred and twenty degrees. This adaptation may be designated as the "double reflecting index glass."

Problem II. To make the sextant capable of measuring two angles, one to the right and the other to the left of an object, *at the same instant*; either angle being any number of degrees from 0 degrees to 120 degrees.

In practice, the hydrographer sets his index arm so that the reflected and direct images of the objects (say left hand and middle) of one of the angles which he is to measure, are not coincident, yet approaching on account of the progress of the boat; then with the second index glass he makes the direct and reflected images of the middle and right hand objects coincident, and keeps them coincident with tangent screw until the first two objects are coincident.

Problem II may be solved in four different forms of the sextant. In Fig. 2, there are one horizon glass and two index glasses; one of the latter mounted directly over the other; but each attached to distinct index arms, which have a common center of motion. The arc is 120 degrees instead of 60 degrees, as in the ordinary forms, and the graduation is numbered in opposite directions, from 0 degrees to 120 degrees (actually at 60 degrees from each zero).

A modification of this form is given, by making each index glass half the width of the ordinary form, their inner edges meeting, as it were, over the center of the instrument, and thus allowing them to move in the same horizontal plane.

Figure 3 exhibits the next solution of this problem, and affords a much more stable instrument, suited to the rough usage of boat duty. This form is unique. There are two index and one horizon glasses, whose center of motion are in the same straight line and in the same horizontal plane; but the index glasses have independent centers of motion, so that the arcs of graduation, although of one piece and in the same plane, have different radii. The graduation is from 0 degrees to 120 degrees from each end to the theoretical junction of the arcs. The index glass nearest the horizon glass, is one-half the height of the other one.

The fourth solution gives to the ordinary sextant an extra index glass, which may either move in the same or a parallel plane to that of the other index glass —and this extra index glass has an arm which moves on the under face of sextant, but its extremity is curved so as to bring its vernier upon the same graduation as the upper index arm.

Problem III. To make the sextant capable of measuring two angles, one to the right and the other to the left of the central object, in quick succession, without previously estimating their relative magnitudes or inverting the sextant or lengthening its arc. This is done by using the ordinary sextant with the addition of a second index glass secured upon the usual index glass, and at an angle of 60 degrees therewith. It is thus evident that when one index glass measures an angle of 120 degrees, the other is at the zero of the first. The index glasses may be placed one above the other, or in the same horizontal plane. With this, there is also added a detachable stop, with vernier at the extremity of the index arm bearing its usual vernier: this stop to be so adjusted that, when clamped, it will allow the index arm to move freely for the next angle.

The ordinary sextant may be made to measure an angle, and give an inter-range, at the same instant, by placing a low mirror upon the frame, and in a line joining the centers of motion of the index and horizon glasses, and at such an angle as to reflect the rays, parallel to the line of sight, from the back object, into the horizon glass. This is a modification of Daussy's improvement, but fulfills many conditions which his will not.

The following paper by Mr. Henry Edwards was presented:

Pacific Coast Lepidoptera.—No. 4. Descriptions of some New Genera and Species of Heterocera.*

BY HENRY EDWARDS.

Family ARCTIIDÆ. H. S.

Spilosoma (Diaphora, St.) *pteridis*, n. sp.

Caterpillar. Head very shining, bright chestnut brown. Body dirty white, mottled with black patches, giving a slate colored tinge to the surface, with three indistinct lines of yellowish-white, two lateral, and one dorsal. Hairs springing from small tubercles, orange-brown, inclining to chestnut, entirely hiding the ground color of the body. Feet and prolegs pale chestnut.

Length, full grown, 1.80 inch.

Food plant, *Pteris aquilina.*

Changed to chrysalis, August, September. Imago appeared, February.

Chrysalis. Formed usually at the base of the fern fronds, a few leaflets being loosely drawn together, and connected by a rather stout web, through which the chrysalis is indistinctly seen. Chrysalis short, rounded in front, blackish-brown, with a few pale brown hairs about the posterior segments.

Imago. ♂. Head, thorax, and abdomen fawn drab, covered with long hairs. Antennæ bright fawn color above, with black pectinations, wholly black beneath. Palpi brownish-black. Wings with the whole upper surface dull smoky-brown, a little darker towards the margins, and with a black discal spot on each. Primaries slightly waved in front on the posterior margin. On the interior margin of the secondaries is a row of hairs of the same color as the abdomen. Feet and legs fawn drab. Fringes blackish.

Under side, wholly fawn drab, reddish along the costal margins, with the discal spot very distinctly shown.

♀ Head and thorax red brown, the former almost scarlet in front. Antennæ and palpi orange red. Abdomen yellowish fawn-color. Feet and legs chestnut brown, with bright red scales above, especially on the middle pair. Fore wings slightly hyaline, reddish chestnut, immaculate, with the nervures very distinctly marked. Costa more decidedly reddish. Fringe chestnut, marked with blackish atoms. Lower wings smoky, with black spot beyond the disc. Fringes pale chestnut, marked with blackish streaks. Under side, wholly dull buff. Costa reddish chesnut. On the disc of each wing is a black lunate mark. The ♀ of this species bears a remarkable resemblance to many specimens of the European *Phragmatobia fuliginosa*, as well as to the same sex of the California *Antarctia punctata.* It may, however, be readily distinguished by its more delicate form, by the absence of spots or other markings, and by the paler color of the under side.

Length of body, 0.50 inch. Expanse of wings, 1.05 inch.

Vancouver Island. (Coll. Hy. Edw.)

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*Printed in advance, February 19th, 1874.

Fam. EPIALIDÆ. H. S.

Epialus Mathewi, n. sp.

♂. Head dark brown, pale above. Thorax and abdomen chestnut, inclining to orange. Antennæ and feet reddish-brown. Fore wings luteous, palest at their margins. At the base is a reddish-brown patch, out of which proceeds a silver-white streak, (edged outwardly and inwardly by a narrow black line) which for a short distance follows the course of the subcostal nerve, then gradually widens and touches the interior margin near the middle, spreading thence upward and outward toward the anterior angle, but becoming obsolete before reaching the extremity, and passing off into irregular black patches with white centers. The edges of this streak are very irregular in outline. Near the disc is a small and indistinct white spot, edged with black, and another is situated near the middle of the interior margin, while the posterior margin is marked with a row of black blotches, not extending to the anterior angle.

Secondaries clouded with fuscous at the base, reddish chestnut toward the margin, with two fuscous submarginal bands united near the middle to the fuscous basal cloud. Fringes of both wings entirely reddish-chestnut.

Under side, pale yellowish-brown, irregularly blotched with fuscous, with the white streak of the upper side very imperfectly seen.

♀ A little larger than the ♂, paler in its general color, with the markings considerably fainter.

Length of body, ♂, 0.70 inch; ♀, 0.80 inch.

Expanse of wings, ♂, 1.40 inch; ♀, 1.65 inch.

Vancouver Island. Mr. Gervase Mathew, of H.M.S. *Repulse*, has kindly added this beautiful and interesting species to my collection.

Fam. BOMBYCIDÆ. Bdv.

Thauma, nov. gen.

Head small, almost concealed by the long hairs which cover all parts of the thorax. Antennæ of the ♀ serrated from base to apex, the serratures largest beyond the middle. Palpi very short, concealed. Thorax densely covered above and below with long hairs, which extend over the base of the wings. Abdomen extending as far as the margin of the hind wings, covered with short hairs, and with a short anal tuft. Legs stout and rather short, of almost equal thickness throughout their entire length. Middle and hind tarsi five-jointed, the last joint receiving and almost concealing the claws. Wings ample, opaque, straight in front, slightly curved outwardly toward their tip, and considerably rounded on their posterior angles. Discal cell very large, subcostal vein reaching the costa a little beyond the middle. The nervures are widely separated toward the posterior margin, gradually decreasing in the width of their interspaces as they approach the anterior angle. This genus is in many respects allied to *Endromis* of Europe, but differs somewhat in the neuration, and in the longer and less pilose abdomen. Perhaps its nearest relations will be found in the South American genera *Ormiscodes* and *Podalia*.

Thauma ribis, n. sp.

♀. Head dull smoky-brown. Thorax smoky in front, chestnut towards its base, hairs very long, smoky, interspersed with gray. Abdomen bright chestnut, darkest toward the anal extremity. Antennæ pale straw color. Feet and legs smoky. Primaries smoky, darkest along the costa. A little distance from the base is a waved whitish line, extending to the costa, broadest at this extremity, and gradually becoming obsolete as it reaches the interior margin. Resting on this is a large white triangular mark, filling up a considerable portion of the discal cell, and looking, when viewed with the wings folded, like the letter V. The right branch of this mark touches the basal fascia, and the left one the subcostal nerve, while its base rests upon a distinct and slightly notched whitish band extending entirely across the wing, widest at the costa, and most deeply notched at its junction with the above V-like mark. The posterior margin broad, smoky, with the nervures yellowish-brown. Both the fasciæ are bordered (the basal one inwardly, and the marginal one outwardly) with blackish scales.

Secondaries, dull smoky, inclining to chestnut towards their base. A little below the disc is a small linear whitish patch, and beyond a waved line of dull smoky black, edged interiorly with whitish scales. Fringes of both wings very short, concolorous.

Under side, primaries with the markings of the upper side indistinctly seen, the marginal fascia becoming smoky black, and the white V-like mark of the upper side a dull yellowish-brown. Secondaries with the waved line very distinctly marked, whitish, bordered externally with black.

Length of body, 1.05 inch.

Expanse of wings, 2.70 inches.

Esquimault; Vancouver Island; Mr. G. Mathew.

This magnificent addition to our insect fauna was raised from the caterpillar stage by my friend Mr. Mathew, who may justly be complimented on the discovery of so remarkable a species. Mr. Mathew describes the caterpillar as being black, with dense and strong spines. It was feeding upon *Ribes divaricatum*, Dougl. Changed to chrysalis in September; Imago appeared October. I hope at some future time to be able to give a more extended description of the earlier stages of this fine insect.

Fam. NOTODONTIDÆ. B.

Stretchia, nov. gen.

Head small, tufted in front. Palpi short, stout, porrect, not extending beyond the head. Proboscis moderate. Thorax slightly crested in front. Abdomen pilose, extending for one-third of its length beyond margin of secondaries. Antennæ rather coarsely pectinate. Tibiæ with long hairs. Tarsi simple. Primaries with the costal edge straight, acute at its tip. Posterior margins rounded interiorly. Interior margins oblique, tufted in the middle. Some plumose tufts are also visible along the costa and subcostal vein. Secondaries small, with the margins much rounded. Larva unknown.

This genus, which appears to bear a close relation to *Edema*, Walk., I have dedicated to my friend, Mr. R. H. Stretch, whose exquisite work on the "Bombycidæ of North America" is an honor to entomological literature.

Stretchia plusiæformis, n. sp.

Head and palpi brownish-gray, sprinkled with white. Thorax gray, mottled with black, with the anterior edge bright reddish-brown. Abdomen brownish stone color, with a black transverse streak, edged with white on the basal segment. Feet and legs brownish-gray, mottled with black. Antennæ dull fawn color. Primaries cinereous, sprinkled over the whole surface with black irrorations. Following the costa, and reaching a little below the subcostal vein, is an irregular pale-gray patch, clouded with black and reddish-brown, reaching its greatest width near the disc, and then becoming paler and more distinct, so as to resemble the markings of many species of *Plusia*. Near the posterior margin is a faint brownish waved line, edged near the interior angle with black. The nervures are black, interruptedly marked with gray. Interior margin with a grayish tuft beyond the middle. Fringes short, brownish-gray, mottled with black. Secondaries pale fuscous, with the nervures very distinct. Fringes a little darker anteriorly.

Under side entirely fuscous, the primaries darker towards the costal margin, and with a very faint brown discal spot. Secondaries covered with paler irrorations and with a well defined lunate discal mark. Abdomen beneath dark brown.

Length of body, 0.60 inch.

Expanse of wings, 1.35 inch.

White Pine, Nevada. Taken on the wing, in August, by Mr. W. S. Edwards.

LIST OF NEW SPECIES.

Spilosoma pteridis...............Vancouver Island.
Epialus Mathewi................Vancouver Island.
Thauma ribis..................Vancouver Island.
Stretchia plusiæformis.........White Pine, Nevada.

Professor Davidson announced that he had received permission from Commodore Ammon to inform the Academy of the important results of the soundings made by Captain George E. Belknap, of the United States Steamer *Tuscarora* during last year, with reference to the projected laying of a telegraphic cable from this coast to Japan. This he proceeded to explain with the aid of a series of large charts and profiles prepared for the occasion. This work exhibited, in a remarkable manner, the depths of the Pacific Ocean, which had no parallel in the plateaus of the

Atlantic. The *Tuscarora* had first started in her line of soundings from the entrance of the Straits of Fuca, across that portion of the North Pacific designated as the Gulf of Alaska, toward the Asiatic coast. After leaving the entrance to the straits, the bottom slopes gradually to a depth of 100 fathoms, and then a sudden descent occurs, which reaches a depth of 1,400 fathoms, at a distance of 150 miles from the coast. The temperature of the water at the greatest depth on this line of survey was 34 degrees.

Commander Belknap then returned, prosecuting soundings off and on, along the coast to the entrance of San Francisco Bay. This work determined the fact that the sudden descent of the bottom of the Pacific to a great depth is continuous down the entire coast, varying from twenty to seventy miles out. In the latitude of San Francisco Bay, the great bench is reached a short distance off the Farallones, where the bottom suddenly descends to a depth of two miles. Off Cape Foulweather the bottom descends precipitately from 300 fathoms to a depth of 1,500 fathoms, and then the plateau continues westward for hundreds of miles, and comparatively as level as a billiard-table. Off Cape Mendocino, where shoals have been erroneously supposed to exist from the seaward jutting of the mountains, a depth of 2,200 fathoms is reached eighty miles from the shore. Thirty miles off the Golden Gate the bottom is reached at 100 fathoms; at 55 miles it has descended to 1,700 fathoms; and 100 miles out, the enormous depth of 2,548 fathoms has been measured without reaching bottom.

Regular Meeting, March 2nd, 1874.

President in the chair.

Sixty-six members present.

A. G. Stiles, Frederick Castle, and Charles Troyer, were elected life members; James Behrens, C. E. Gibbs, John McHenry, Jr., Walter Van Dyke, Carlton W. Miller, Edward Steele, James Mc-

Kinley, William H. Sharp, and Josiah Belden, were elected resident members.

Donations to the Library: Catalogue of the Phalænidæ of California, No. 2, by A. S. Packard, Jr., M.D., from the author; Proceedings of the Academy of Natural Sciences, of Philadelphia: pp. 409–424; Overland Monthly for March, 1874, from publishers; Transactions of the American Institute of Mining Engineers, Vol. I, May, 1871, to February, 1873; California Horticulturist, February, 1864, from publishers; Monathsbericht der Königlichen Preuss. Akad. der Wissenschaften, zu Berlin, November, 1873; Annual Meeting of the Am. Geogr. Society, January, 1874; American Chemist, Philadelphia, February, 1874; Map of the Sources of Snake River, from the Dept. of Interior; Engineering and Mining Journal, New York, February 14, 1874.

By purchase: Popular Science Monthly for March, 1874; Journal of Botany, London, February, 1874; Annals and Magazine of Natural History, London, February, 1874; Proceedings of the Royal Geographical Society, London, January, 1874; Annalen der Physik and Chemik, No. 11, Leipzig, 1873.

Professor Davidson announced that he had received a letter from Alexander Agassiz, offering the Society, according to the expressed wish of his deceased father, a set of the *Flora Braziliensis*, which work, in thirty-four volumes, was now upon the shelves of the Society.

Donations to the Museum: From I. W. Raymond, specimens comprising walrus teeth, fishing implements, carvings, costumes, etc., from Alaska, and spears, war clubs, hunting implements, from the South Sea Islands; from Mrs. Capt. Shelley, samples of Tapa or Kapa, a cloth manufactured by natives of the Samoan Islands; also specimens of the bark from which it is made; from Capt. Oliver Eldridge, specimen of *Diomedea exulans*, and a paroquet, both stuffed and mounted; from Vicente Denis, of the Coast Survey, four species of shells, from the kelp off San Miguel Island, in Santa Barbara channel; from W. W. Russel, specimens of *Lycopodium* from Sandwich Islands; from Alfred Gros, skeletons of male and female otter, with numerous shells, sponges, corals, and other specimens from Alaska; from Mrs. A. McF. Davis, several curiously formed bricks, which have apparently been subjected to the action of fire, each bearing strange hieroglyphics; they were dug up near Saucelito. From Judge Ford, of Martinez, through Barry & Patten, a fossil tooth of an extinct species of shark (*Carcharodon*). It was found imbedded in the rock at Martinez, from which it was

taken with hammer and chisel. This is the same tooth which was the subject of a paper by Dr. Blake, at a recent meeting. Mr. G. F. Barker also sent through the same gentlemen a small tooth, procured while digging a well at San Bruno. The tooth is supposed to be that of an extinct species of buffalo, (*Bison latifrons?*) A medal was also received from the Royal University of Christiania, celebrating the thousandth anniversary of the Norwegian Kingdom.

Dr. H. C. Sill exhibited skins of *Aplocerus montanus*, from Montana.

Mr. W. H. Dall presented the following paper:

Notes on the Avifauna of the Aleutian Islands, especially those West of Unalashka.*

BY W. H. DALL, UNITED STATES COAST SURVEY.

The following notes are the result of observations made during the season of 1873, on board the United States Coast Survey cutter *Yukon*, engaged in surveys among the Aleutian Islands, west of Unalashka. That they are not more extensive, is due to the very engrossing nature of our work in other directions; yet I am inclined to believe that nearly, if not quite, all the species common to this part of the chain, have been detected. There may be occasional visitors which we did not obtain; there are, perhaps, one or two species of Alcidæ which, from their habit of living for the most part off shore in the summer, were not recognized; and doubtless the range of many species might, by careful observations on each island, during the winter, be much extended; yet it is probable that the information here collected approximates more nearly to a correct statement of the geographical distribution of the Aleutian birds, than anything previously published.

I have preferred, for the sake of uniformity in my papers on Alaskan birds, to retain a nomenclature which, though more widely recognized than any other in America, is rapidly becoming obsolete, and which I would not be understood as accepting in its present condition. I trust eventually to review the whole subject in one comprehensive memoir, when I shall be able to have access to all the later literature of the birds of the more northern regions of the world, which is not now the case; and then I hope to reconcile the discrepancies, and correct the errors, of the nomenclature which I have made use of for the present.

I have been struck with the fact, that during successive seasons, in the same locality, the local Avifauna has presented different aspects—species abundant one season being absent during another; and I had intended to prepare a series of tables, showing the mean distribution of the Aleutian birds, and some of

*Printed in advance, March 14th, 1874.

their fluctuations in range. On reconsidering the matter, I have become convinced that it would be better to wait as long as possible before attempting this work, and until I have finally closed the investigations now in progress. Each year has presented new facts, and modified our views of old ones; and, as our field may be still further enlarged, and our observations supplemented to a considerable extent, a reasonable delay may add a good deal to the accuracy and value of the tables indicated.

I would call special attention to the fact that no intrusion of Asiatic forms occurs toward the western end of the chain; and also, that the birds of that region are reinforced by several Arctic forms, not included in that part of the archipelago near the continent to the eastward. This peculiarity in distribution is more marked when we regard the plants, coleoptera, and marine invertebrates, as well as the birds, all of which groups present the same peculiarity in a more striking manner than the birds themselves. This may be due, in part, to the temperature, which is affected by the Arctic current which sweeps down the Kamchatka coast, although it passes some distance west of the islands.

We noted that on those islands, such as Attu and Atka, where the Arctic fox and other land animals have been introduced by the Russians, the birds preferred to build on islets and rocks off shore, or not accessible from the beaches. But on those islands where there are no such animals, the habits of the same species are quite different. They build, without fear, on the banks and hillsides of the main island, and are not found on the rocky islets at all. This indicates not only a change in habits brought about within historic times, by the struggle for existence, but also, that the progeny of individuals probably continue to reside on the same islands as their progenitors.

On Amchitka, a low island, which was abandoned by the Russians in 1849—and which has not been visited since, except by our party—the birds were remarkably bold and fearless, scarcely stirring at our approach, and confidently disporting in the water close to the vessel. This was especially noticeable in shy and timid birds, such as the loons.

The numerous species of small auks and puffins for which this region is famous, are peculiar in their habits. They spend the larger part of the day, at a distance from shore, varying from two to fifteen miles; enormous flocks covering acres sociably sitting on the water close to one another, feeding or sleeping, even in rough weather. They prefer places where the currents form streaks on the water, or narrow eddies, as here are collected much of the wash from the shores, small pieces of sea-weed, and the small crustacea feeding on the decaying sea-weed, which form the principal food of the birds. The birds also eat a good deal of sea-weed, their stomachs always containing more or less of it mixed with fragments of crustacea. The auks, puffins, and smaller divers, seem to subsist entirely on these matters. I have never seen them eat mollusks, echini, or other invertebrates, even when the shore was strewn with them. The murres, puffins, and larger divers, consume a great many small fish, but never any dead matter, so far as I could observe. On the contrary, the gulls and crows perambulate the sand with fantastic motions, watching the ebb of the tide, and

eagerly seizing on anything which may be stranded, dead or alive. They are particularly expert in seizing the large common echini, (*S. Dröbachiensis*) breaking them on a stone, and devouring the well-filled ovaries.

While off shore, the flocks of auks may be seen leisurely swimming in groups of thousands, against the current; occasionally, if it is too strong for them, rising all together and settling down in their old position relative to the shore. The murres sometimes intrude among the smaller auks, but, as a general proposition, each species keeps strictly by itself, though there may be several species, in flocks of thousands, within a few yards of one another. I believe they obtain most of their sleep in this manner. Towards evening, they all come in shore together, as the sun goes down, and remain on the edges of bluffs and high banks, or in the still waters of the harbors, screaming, whistling, quarrelling, and making a great disturbance, all night. With the first gleam of dawn, they go out to sea again. I believe, also, that with these birds the male does a large proportion of the incubation; I have rarely found a female on the nest; especially in the day-time, I do not remember a single instance. This holds true of the mormons, urias, small auks, and both species of the petrels.

For the convenience of those who may find it difficult to recognize the geographical names of localities, (seldom given, and when given, usually misspelled on the ordinary maps) I add a list of the approximate positions of our stations in the islands during the past year:

	Lat. N.	Lon.
Chichagoff Harbor, Attu Id..........	52° 55′ 57″	173° 12′ 22″ E
Kyska Harbor, Great Kyska Id.......	51° 59′ 00″	177° 30′ 00″ E
Constantine Harbor, Amchitka Id.....	51° 23′ 33″	179° 12′ 12″ E
Bay of Islands, Adakh Id..............	51° 49′ 16″	176° 52′ 00″W
Nazan Bay, Atka Id.................	52° 10′ 30″	174° 15′ 00″W
Iliuliuk Village, Unalashka............	53° 52′ 57″	166° 31′ 36″W
Popoff Strait, Shumagin Ids...........	55° 19′ 17″	160° 31′ 14″W
Sannakh Reefs......................	54° 28′ 00″	162° 52′ 00″W

1. *Falco gyrfalco*, Linn. Jerfalcon.

The form of Arctic falcon, referred to under this name, is, according to Professor Baird, the true *gyrfalco*, as distinguished from *candicans*, and *islandicus*, and is now obtained, for the first time, in American territory. A male was obtained in the harbor of Kyska, June 30th, 1873, being one of several which had their nests on the brow of a precipitous and inaccessible cliff at the west end of the harbor, perhaps a hundred and fifty feet above the water. The same species was observed flying over the low island of Amchitka, a little later in the season. It does not appear to be common, but was the only hawk observed in the islands west of Unalashka. It appeared to pass most of its time near the nest, and raised a loud outcry when any one approached the base of the cliff, on the beach below. The fragments of several ptarmigan, probably remnants from some of its meals, were noticed at the foot of the bluff below the nest. Shot, as it was,

in the head, I was unable to determine the color of the eyes in the specimen obtained. I presume the bird to be, like the species found at Unalashka, a resident.

2. *Haliaëtus leucocephalus*, Sav. (43). Bald Eagle.

Observed at Attu, and a resident throughout the Aleutian chain; everywhere occurring in the greatest abundance. So far as my observations go, it does not confine its diet to fish, but also destroys grouse and other birds. At the time when we left the islands, in October, the young of the year were still unable to fly. *H. pelagicus* has not yet been obtained from American territory. It is found at Petropavlovsk, Kamchatka; but I believe that it cannot properly be included in our fauna. *A. canadensis* was not observed to the westward.

3. *Brachyotus palustris*, (52). Short-eared Owl.

Observed in all the islands from Attu eastward. A resident. Nests in burrows, in hill-sides or grassy banks.

4. *Hirundo horreorum*, Barton. (225). Barn Swallow.

This species was obtained abundantly at Unalashka, on and after June 9th, 1873. It is said to nest in the upper portion of the church and other buildings at the village of Iliuliuk. A swallow is also reported as occurring at Atka, which is probably the same species. It does not occur at Attu. A summer resident.

5. *Troglodytes hyemalis*, var. *alascensis*, Bd. (293). Wren.

Obtained in Attu and the Pribyloff Islands, a resident throughout the Aleutian chain, and everywhere very abundant and tame; but we have not yet been able to discover the nest and eggs, though the young birds were very plentiful in Amchitka in July.

6. *Leucosticte griseinucha*, Bon. (323). Gray-necked Finch.

The westernmost point at which this species was obtained was Kyska. It was not observed at Adakh or Amchitka, but occurs in all the larger islands east of Kyska. It is a resident, and breeds in May. I have observed no transitional forms in the Aleutian Islands which would connect this race with *littoralis*.

7. *Plectrophanes nivalis*, Lin. (325). Snowbird.

A resident; universal throughout the Aleutian and Pribyloff Islands. A nest with five eggs, in a fresh condition, was obtained on a low grassy bank, June 20th, 1873, at Chichagoff Harbor, Attu. Another nest, with four much developed eggs, was obtained June 23d, in a similar locality.

8. *Plectrophanes lapponicus*, Selby. (326). Lapland Longspur.

A nest with four much-incubated eggs was obtained at Attu, June 18th,

and the bird was abundant. It builds in the same localities as *nivalis*. This bird was obtained in Attu, Kyska, and Adakh, but not in Amchitka, which is a low island. We did not see it at Atka, and I am certain that it does not occur in Unalashka, or the islands east of the latter point. In the localities where it is found, it is a summer visitor only, disappearing after the young are able to fly.

9. *Passerculus sandwichensis*, Bd. (333). Sparrow.

Abundant, as usual, in Unalashka, but not passing west of that island. A summer resident.

10. *Melospiza insignis*, Bd. (362*). Song Sparrow.

A resident during the year throughout the Aleutian Islands. The young had obtained a considerable size early in July, at Kyska. There appear to be two tolerably well-marked varieties of this bird, found in the same localities; one of pure ashy tints, and the other much tinged with rufous brown.

11. *Corvus carnivorus*, Bartr. (423). Raven.

A resident throughout the islands, but does not occur in the Pribyloff group, and is less abundant where there is no population. A few young ones were taken to St. Paul Island in the spring, in the hope that they might be of use in devouring the remains of the seals killed there, which cause a very offensive odor during the hunting season.

12. *Lagopus albus*, Aud. (467). Ptarmigan.

More or less abundant in all the Aleutian Islands. The eggs are numerous, and laid in a rounded depression in the upland turf, or moss. June 21st we obtained nine much incubated eggs, at Attu; and young grouse were abundant at Kyska, July 8th. We endeavored to rear some, but could not induce them to eat anything.

From careful examination of many specimens, most of which were killed for the table, I feel sure that this is the only species of grouse found on the islands, and I believe there is no authenticated instance of the occurrence of *L. rupestris* west of the 156th meridian.

13. *Hæmatopus niger*, Pallas, (513). Oyster-Catcher.

Very abundant at Adakh; seen at Kyska and Amchitka. A summer resident, arriving in May, and breeding in the islands. It is probably found at various times on all the islands, though frequenting some more than others. We did not see or hear of it at Attu.

Iris of a rich orange color; edges of eyelids scarlet.

14. *Lobipes hyperboreus*, Temm. (520). Northern Phalarope.

This species was obtained, breeding, at Kyska, June 30th, 1873. The number

of eggs varied from two to four. The nests were rounded depressions in the turf, usually found in low and marshy localities. It is a summer visitor, and we were unable to find it anywhere in the islands except at Kyska—a somewhat singular fact. Had it occurred at any of the other stations visited, we should probably have detected it. It is not found at Unalashka.

15. *Tringa maritima*, Brün. (528). Purple Sandpiper.

A summer resident, breeding throughout the Aleutian and Pribyloff Islands. Obtained from Attu eastward.

16. ——— ———?

A species of plover, or sandpiper, with a nearly white body and dark wings, about the size of the last species, was seen on two occasions at Attu, in June. Unfortunately we were unable to obtain a specimen, and we did not see it anywhere else.

17. *Limosa uropygialis*, Gld. (549*). Godwit.

This species was, on the 9th of June, again obtained at Unalashka, where it breeds. It is a summer resident, and has not been observed to the westward of this point, though it ranges north to the Yukon.

18. *Cygnus americanus*, Sharpless. (561*). Swan.

Mr. Thompson, an otter-hunter who wintered in Sannakh Island, 1872–3, reports that he killed three of these birds in September, 1872, and that they were not uncommon during the autumn. They have not been reported from any part of the Aleutian chain proper.

19. *Anser Gambellii*, Hartl. (565). White-fronted Goose.

These birds are reported as occurring in small numbers, spring and fall—during their northern and southern migrations—at Attu, Unalashka, and Sannakh. I have not heard of them at intermediate points, and as they make no stay, they can only be regarded as casual visitors.

20. *Bernicla nigricans*, Cas. (571). Black Brant.

This bird, like the last species, passes the islands in its annual migrations, and does not breed to the eastward of Amchitka. Unlike the *Gambellii*, however, a small number do remain and breed on the Semichi Islands near Attu, Kyska, and Amchitka. Eggs of this species were obtained on the Semichi Islands, June 15th, and young, unfledged goslings on Kyska, July 10th. It is not abundant, however, and breeds on the highest hill-tops, and not, as in more northern regions, on the lowlands. It has also been reported as a casual visitor at the Pribyloff Islands. On our return to the coast of California, in the latter part of October, enormous flocks of this species were seen about 100 miles off shore, from the vessel, flying south, frequently alighting in the water near the ship.

21. *Philacte canagica*, Ban. (573). Emperor Goose.

This species—rarely found in winter near Unalashka, and not at all to the westward—is reported by Thompson to congregate in great numbers on the low, marshy island of Sannakh, during the entire winter. To these birds he and his companion owe their preservation during an attack of the scurvy, which nearly proved fatal to them both. They migrate northward in May.

22. *Nettion carolinensis*, Bd. (579). Green-winged Teal.

A resident throughout the islands as far west as Kyska; casual, in summer, at Attu. This species was one of the two or three upon which we principally relied for supplying our table during the season of work amongst the islands. Young ones were abundant at Amchitka, in July.

23. *Harelda glacialis*, Leach. (587). Old Squaw.

A resident as far west as Kyska, not seen or heard of at Attu. Individuals are less plentiful as we go west from Unalashka, and it is nowhere very abundant.

24. *Polysticta Stelleri*, Eyton. (298). Steller's Eider.

This species is reported by Thompson as wintering abundantly at Sannakh Island. As an illustration of the irregularities which obtain in the range of migration of birds in different seasons, it may be mentioned, that while in May, 1872, this species was very abundant at Unalashka, together with the next species, yet in May, 1873, not a single one of either was observed, though the season was later by a month than the previous one, and the birds in question winter in large numbers at Unalashka.

25. *Somateria v-nigra*, Gray. (607). Pacific Eider.

Apparently a resident in the islands. Wintering abundantly at Unalashka, it seems to seek its breeding-grounds in those islands to the westward which are not inhabited. At least, it seems quite certain that the large flocks which winter in Captain's Bay do not breed in the immediate vicinity; while it is the most common duck in the western islands during the summer.

26. *Mergus serrator*, Lin. (612). Saw-bill. Water-hen.

Obtained at Amchitka, the only locality in the islands where it has yet been observed, and rare there—apparently breeding. A summer visitor.

27. *Graculus bicristatus*, Pallas. (627*). Shag.

Resident in the Aleutian and Pribyloff Islands. The following notes were made from two fresh specimens killed at Amchitka, July 27th, 1873.

No. 1. (290.) ♀ Iris pale olive brown; base of mandibles and culmen bright blue, remainder of naked space scarlet. Two pronounced tufts on the head.

No. 2. (291.) ♂ Iris olive brown; base of mandible dull ashy blue, with a narrow orange border to the naked membrane, which was much more invaded by scattering feathers than the other, and dull colored. Tufts ill-defined, or none.

28. *Graculus Bairdii*, Gruber. Lesser Cormorant.

This bird, which resembles what has been supposed to be a variety of *violaceus*, Gray, is also a resident of the Aleutian chain. Specimens from Kyska, July 8th, ♀ had a brown iris, and the naked membrane somewhat carunculated, and of a coral red, mandible nearly black. Others from Amchitka, July 26th, had a dark green iris, and a similarly colored gular sac. One obtained in 1872, at Unalashka, had a dark, nearly black, iris, with the gular sac flesh color, passing into ashy gray above. All appear to possess small white feathers scattered through the plumage in the breeding season, but I am not sure that the white thigh patches are always of this character. There appears to be some variation also in the shade of green of the plumage; in some specimens it is much more rusty than in others. I am informed by traders who visit Copper and Bering Islands, that there are several varieties of cormorants and small auks found there, which they have not seen in the Aleutian chain. Some of these may be included, as well as some from the Kurile Islands, in the old descriptions, with an erroneous Aleutian habitat assigned to them.

29. *Diomedea brachyura*, Cas. Mottled Albatross.

Abundant off shore throughout the Aleutian Islands, where it takes the place of *D. nigripes*, which seldom ventures north of lat. 50° north. It probably breeds in the islands, as we saw the mutilated carcass of a very young one, in August, at Atka. Its bones were tolerably abundant in the Aleutian "Kitchen midden," or ancient shell heaps. It is much larger than *D. nigripes*, and never follows a vessel, as is the custom of that species. Apparently a resident from Attu eastward, as we saw a dead specimen on the beach, in the winter of 1871-2, in Unalashka.

30. *Diomedea nigripes*, Aud. (633ª). Gony.

Full notes have been given on this species in previous catalogues, and our observations during the past season confirm, without adding anything to our information already published. It has always been a question where this species breeds, and I am glad to be able to state, on the authority of Captain Geo. Holder, that it nests on the coral island of Gaspar Rico, near the equator, in the winter season. This gentleman, who is an intelligent and trustworthy observer, informs me that on a voyage in search of new guano islands, he touched at Gaspar Rico, and found this bird, together with a species of petrel, and a tern, breeding abundantly in a low scrubby growth of bushes, which are the only representatives of trees on that island. His impression was that it laid but one moderately sized, white egg, in a depression in the soil, around which a little sea-weed or dry herbage was gathered. It is not known to breed anywhere on the northwest coast of America, or the northern Pacific islands.

31. *Thalassidroma Leachii*, Temm. (642). Petrel.

This species, not noticed east of Amchitka, breeds abundantly on the rocky islets off Attu, and on the highlands of Kyska and Amchitka. As in the next species, the male seems to do a large proportion of the incubation, and, as a rule, they lay only one small, white egg, in a burrow from six inches to a foot in horizontal length. This burrow is often curved considerably to one side, and I have never seen one absolutely straight. The burrow is usually in the side of a turfy bank. This, and the next species, have the habit, when handled, of disgorging a reddish, oily fluid, of strong and disagreeable musky smell; and one can tell, by the odor of the burrow alone, whether it is tenanted by a petrel, or one of the *Alcidæ*. From this habit, the petrels (of which species I am not certain, but think it to be this one) which breed off the coast of Mendocino County, California, have received there the name of "Musk Birds." While breeding, they are largely nocturnal in their habits. We found fresh eggs from June 10th to the end of July. The eye of both these petrels is of a dark brown, almost black after death. The specimens from the islands are darker than those from Sitka. They can be considered as summer residents, going south in winter, and arriving at the islands in May.

32. *Thalassidroma furcata*, Gld. (643). Gray Petrel.

The remarks under the head of the last species will generally apply to this one also, but it is found breeding on all the less populated islands, as far east as Unalashka. Unlike the reported habits of the North Atlantic petrels, they are never seen in stormy weather at sea; nor do they ever follow in a vessel's wake, as far as my observations go. They are occasionally seen flying about in calm, fine weather, throughout the North Pacific.

33. *Lestris parasiticus*, Temm. (654). Skua.

These birds were obtained in the breeding season at Kyska and Amchitka, and in winter at Unalashka, rarely. They are nowhere common; nor have we ever obtained any in completely adult plumage. All our specimens are of a nearly uniform dark slate color. They are probably residents. The eye is nearly black.

34. *Larus glaucescens*, Licht. (557). Glaucous Gull.

The common and only gull of the islands; resident throughout the chain, but more abundant to the eastward. Breeds in May and June. We obtained nearly fledged young at Kyska, early in July. The eye is of a lighter or a darker steel gray.

35. *Rissa tridactyla*, Bon. (672). Kittiwake.

Rare in the western islands, not venturing into the protected bays and harbors much, but apparently a resident. No other species of kittiwake was observed west of Unalashka.

36. *Sterna macrura*, Naum. (690). Arctic Tern.

The only point at which this beautiful little tern was observed west of the Shumagins, was at Amchitka, where it was abundant.

37. *Colymbus torquatus*, Brün. (698). Loon.

Breeds at Kyska, abundant at Amchitka in July. Not seen elsewhere, except at the Shumagins. A summer resident.

38. *Colymbus septentrionalis*, Lin. (701). Red-necked Diver.

Very abundant at Amchitka in July, where it was breeding. Seen nowhere else in the Aleutian chain. A summer resident. We observed six or eight of them at a time in the harbor of Amchitka, quite bold in their behavior, usually appearing in the early morning, or the dusk of evening. Crossing the island one day, we observed a female of this species with one young one, swimming in a pool of fresh water. Alarmed by our approach, the mother did not attempt to fly, but settled down in the water, until only her neck appeared above the surface, while the little one immediately took up its position on her back. Wishing to obtain the early stage of the bird, we shot the young one, and picked it up. Soon after, the male arrived from the west coast of the island with a small fish in its mouth, evidently intended for the young one. Not seeing it, he uttered a mournful cry, which was replied to by the female, who had remained in the pool without attempting to escape. For some minutes the conversation was kept up, and then both took wing, and disappeared, still uttering low moaning cries at intervals.

I have never seen loons, of either species, as abundant anywhere else as they were at this island, which had not been visited by a vessel since 1849.

39. *Mormon cirrhata*, Bon. (712). Tufted Puffin.

A resident; abundant throughout the islands, more especially the unfrequented ones, but more rare as we go east from Unalashka. The skins of this species are used for making long coats, or hunting shirts, by the western Aleuts; and the light feathers frequently used in their embroidery are mostly taken from its long tufts. They appear to lay two eggs, and we found fresh eggs of this and the next species from May to the end of July.

40. *Mormon corniculata*, Naum. (713). Horned Puffin.

A resident; abundant from Attu to the Shumagins, and having habits similar to those of the last species. The eyes of both have the iris of a clear, dead white color.

41. *Uria columba*, Cas. (727). Red-footed Diver.

Abundant anywhere from Attu to the Shumagins, but not seen in winter. The young have dark bluish-black eyes and feet.

42. *Uria californica*, Bryant. (730*). Murre.

Abundant, and apparently a resident all through the islands. Less common and more shy than the last, but, unlike *U. columba*, congregating in immense flocks a few miles off shore. I have never seen the last species going in a large flock; there are seldom more than two or three together.

43. *Ombria psittacula*, Cassin. Parroquet Auk.

Not uncommon at Amchitka, but not seen anywhere else. A resident. The iris is white. I think Brandt is mistaken in supposing the peculiarly shaped bill is used in prying open bivalve shells. I have never found anything in its crop except fragments of crustacea, and I think that the bird uses its sharp, recurved, lower mandible in tearing out the softer parts of the larger Isopods, and in picking them out of crevices in the rocks, and from under round stones.

44. *Phaleris cristatella*, Bon. (719). Sea-quail.

Abundant in large flocks, covering acres, off shore; from Kyska eastward, but very rarely seen in the bays and harbors. A resident.

45. *Brachyrhamphus antiquus*, Br. (736). Ancient Auk.

Abundant throughout the islands, especially in certain localities; we obtained it from Kyska eastward. While this species also congregates off shore in very great numbers, it yet frequents the bays and harbors much more than any of the other small auks. The iris is white. From observations of many specimens and large numbers of the living birds of all ages, I have become satisfied that the young of this species is the bird obtained by me in Unimak Pass, in 1865, and which was described by Dr. Coues as *Simorhynchus Cassini*. Brandt refers *Cassini* to the immature form of *Kamchaticus*, but *Kamchaticus* has never been authentically identified from the Aleutian chain, and I doubt its occurrence there. I think it quite probable that many species, properly belonging to the Kurile and Commander's Islands, and to the coast of Kamchatka, have, in confusion of geographical names, and ignorance of these rarely visited regions, been attributed erroneously to the Aleutians.

It is quite likely, also, that the young of several of these small auks may closely resemble one another. However, it is certain that I have never seen nor obtained *S. Cassini*, except where *antiquus* was abundant. I have seen it among the flocks of *antiquus* on the water, and shot it out of these flocks. Every one who has carefully watched the different species of small auks, has observed that each species keeps strictly to itself; large flocks of each may be feeding adjacent to one another, but they never mingle. The only exception to this rule is the murre, which sometimes intrudes into a flock of the smaller auks. Lastly, the plan of color in *Cassini* is the same as in *antiquus;* and the advancing stages of the former approximate more and more closely to the latter. No doubt remains in my own mind in regard to their identity.

Among other specimens of the young form, one was obtained at Amchitka, with a curious malformation of the lower mandible, which was nearly one-half shorter than the upper one. The bird, however, was healthy and fat.

In closing this list, which I believe to be very nearly a complete one of the birds west of Unalashka, I have to thank Messrs. Frost and McCarty, of the A. C. Co., agents at Attu and Atka, respectively; and Captain E. P. Herendeen, and other members of my party, who made the most of the scanty leisure afforded by our summer's surveying work, in assisting to make the collection as complete as possible.

Mr. Stearns read a translation from the reports of the Society for the Preservation of Norwegian Antiquities; describing the excavation of an ancient vessel, of the Viking period, found in the parish of Tane, Norway.

Judge Hastings read a paper on the "creeping" of railroad tracks.

The President made the following remarks in addition to the paper on deep sea soundings, read in the last meeting:

In the communication made at the last meeting upon the subject of the deep sea-bottom of the Pacific, I omitted to mention the fact that the average depth of this ocean, on a direct line between Japan and California, had been determined in 1855, by Professor Bache, of the Coast Survey, from the discussion of the observations of the transmission of the great earthquake waves of December, 1854. The matter is not new, but is worth repeating in connection with the present subject.

The character of these waves being ascertained, and also the time of their transmission, the average depth of the ocean in their path can be determined. The rate of motion of the crest of the wave from Simoda to San Diego, was 370 miles per hour, or 6.2 miles per minute; to San Francisco, 355 miles per hour, or 6 miles per minute. The duration of an oscillation on the San Diego path was 31 minutes; the duration of an oscillation on the San Francisco path 35 minutes.

These data yield, for the length of the wave on the San Diego path, 186 to 192 miles, and on the San Francisco path, 210 to 217 miles.

Now, a wave of 210 miles in length would move in a velocity of 6.0 miles in a depth of 2230 fathoms, and a wave of 217 miles in length would move with a velocity of 6.2 miles per minute, in a depth of 2500 fathoms.

In a similar manner was derived the average depth of 2100 fathoms on the San Diego path.

Regular Meeting, March 16th, 1874.

Vice President in the chair.

Forty members present.

James Whartenby was elected a life member, and Edwin Merrifield, John H. Bostwick, G. W. Dunn, Benjamin Roop, and Lovell Squire, resident members.

Donations to the Library: Geological Survey of Missouri, one volume, 1872, and atlas; one volume of Reports on the same, 1855–1871, presented by G. C. Broadhead; System of Entomology, a continuation of Buffon's Natural History, by Gustav Jablonsky, Berlin, 1783; presented by James Behrens; Engineering and Mining Journal, New York, 1874, Vol. XVII, Nos. 8, 9, and 10; Societié Entomologique de Belgique, No. 95; Nature, Vol. IX, Nos. 224 and 225; Quarterly Journal Geological Society of London, Vol. XXX, Part 1st, 1874; Astronomical Register, London, February, 1874; Report of the Chief of Ordnance, 8vo., Washington, 1873; Annalen der Physik und Chemie, Leipzig, No. 12, 1873; American Naturalist, March, 1874; American Journal of Sciences and Arts, March, 1874; Proceedings Philadelphia Academy of Natural Sciences, 1873, pp. 425–470; Verhandlungen der Gesellschaft für Erdkunde, Berlin, 1874, No. 1.

Donations to the Museum: From W. J. Fisher, skull of an *Orca*, or killer-whale, from the Arctic Ocean; from W. H. Dall, ear-bone of *Megaptera versabilis* Cope, skull of *Lagenorhynchus obliquidens* Gill, and of the California Gray Whale, *Rhachianectes glaucus* Cope, all from Monterey, California. The cranium last mentioned is about eight feet long, and (with the exception of one collected at the same time, and presented to the National Museum at Washington) is the only bone of this gigantic and formerly abundant animal, in any museum in the world. Mr. Dall also presented a very old prehistoric Aleutian cranium from the Amaknak Cave, a record of the exploration of which has already been published in these Proceedings; from Jas. E. Perkins, a specimen of *Octopus;* basalt from Olompali Rancho, Marin County, California, from W. A. Goodyear; from Dr. Behr, a specimen of salamander, *Batrachoceps attenuatus* Bon.; five species of birds from Mr. F. Gruber: *Melospiza fallax*, *Paroaria dominica*, *Calypte anna*, *Sialia mexicana*, and *Agelaius gubernator*.

Mr. Stearns read the following paper:

Remarks Suggested by Dr. J. E. Gray's Paper on the "Stick Fish," in "Nature," Nov. 6th, 1873.

BY ROBERT E. C. STEARNS.

At a meeting of this Academy on the 3d of February, 1873, certain switch-like rods, being the axes of some polyp-form, as well as the general characters of Alcyonoid Polyps, were considered and discussed, for the purpose of tracing by analogy and determining the relations and position of the specimens under consideration at that time; and it may be remembered that a paper was read, in which was given at considerable length a resumé of what had appeared in the columns of *Nature*, in the way of notes and comments by several learned gentlemen.

These rods, switches, or wands, as the specimens had been variously called, were first brought to the notice of the Academy on the 5th of June, 1871, when specimens were presented to the Museum, and, so far as an opinion was expressed at that time in a general way, the specimens were placed near the group to which it has been subsequently proved that they belong.

On the 4th of August, 1873, Dr. James Blake submitted an entire specimen of the polyps, of which the rods, etc., are the central stalks or axes: that is, one of these rods or switches was presented by him, with the investing soft or fleshy covering, which proved it to be either a *Pavonaria*, or closely related to that genus. Accordingly, I published a description placing it in the genus *Pavonaria*, and gave it the specific name of "Blakei," (*Pavonaria Blakei*) and the same was printed in the *Mining and Scientific Press* of this city, August 9th, 1873.

Before the succeeding regular meeting of the Academy, which took place August 18th, 1873, through access to more recent literature bearing on the subject, I perceived at once that not only was the species new, but that its separation generically was warranted, and the sub-genus *Verrillia* was made by me to receive it; and a description of the genus and species was read at that meeting, and printed copies of my paper (dated August 20th) were sent to various authors, societies, and scientific journals, in advance of the regular publication of the Academy's Proceedings.

Among the many scientific gentlemen who had discussed the character and relations of the so-called switches, Dr. P. L. Sclater, of the Zoölogical Society, kindly gave publicity to *Verrillia Blakei*, in *Nature*, for October 9th, 1873.

In the same journal, of date Nov. 6th, 1873, Dr. J. E Gray, of the British Museum, publishes a communication "On the stick-fish, (*Osteocella septentrionalis*) and on the habits of sea-pens," in which he refers to a specimen presented to the Museum by Mr. Coote M. Chambers, and of which he says: "Unfortunately the specimen did not arrive in a good state for exhibition. The greater part of the animal portion had been washed off, probably by the motion of the

solution during the transit; only about a foot of the flesh which was loose on the axis, and the thick, swollen, naked, club-shaped base, without polypes, remained; but it was in a sufficiently good state to afford the means of determining its zoölogical situation, and of examining its microscopical and other zoölogical characters."

In the next paragraph, of which I quote a portion, Dr. Gray says: "Mr. Chambers' specimen is the animal of the axis or stick, that I described as *Osteocella septentrionalis*, (Ann. and Mag. Nat. Hist., 1872, p. 406) * * * * * and is evidently the same animal as *Pavonaria Blakei*, described by R. E. C. Stearns."

"Two days after I received this specimen, I received by post Mr. Stearns' description of the stick fish, (*Pavonaria Blakei*) from the San Francisco *Mining and Scientific Press*, August 9th, 1873."

Towards the close of his article, Dr. Gray writes: "Mr. Stearns' paper, in the Proceedings of the California Academy of Sciences, is a reprint of the paper in the San Francisco *Mining and Scientific Press*, with a few additions, and the addition of a new sub-genus, *Verrillia*, although he quotes *Osteocella*." In this paper Mr. Gray gives what he considers "the synonymy of those animals"; first, the genera, and next, the species; placing my first generic determination, *Pavonaria*, and my subsequent sub-genus, *Verrillia*, in the order as recited, as synonymes of his genus *Osteocella*.

I would ask Dr. Gray by what warrant, either of science or justice, he places *Pavonaria* or *Verrillia*, definitely described genera, as synonymes of his indefinite and vague *Osteocella*, which latter he *publishes* as a genus, for it cannot be said he *describes* it, in the "Catalogue of Sea-Pens—or Pennatulidæ—in the British Museum" 1870, page 40. Gray's genus *Osteocella* is based upon a "bone," (probably the axis of a polyp) which was sent to the British Museum "many years ago," from Australia, by a gentleman named Clifton. The investing fleshy substance, or soft portion of the animal, of which said bone formed a part, had not been seen by Dr. Gray at the time he invented the name *Osteocella*, and even to this date no additional light has been furnished by him regarding the Australian form. He was not even *positive* that the "bone" belonged to a zoöphyte, for he says: "or, it may be the long conical bone of a form of decapod cephalapod which has not yet occurred to naturalists, as Mr. Clifton spoke of its being a free marine animal: it has a cartilaginous apex like the cuttle fish."

In which of the great divisions of the animal kingdom does Dr. Gray place it, or did he place his Australian bone in 1870?

Courtesy and fairness suggest that as he printed it in the Catalogue of *Pennatulidæ*, it should be conceded, as I have written, in a previous paper, "that, in his mind, the balance of reasoning tends in that direction."

Admitting this latter, what then? The Australian bone upon which rests his genus *Osteocella* is described by Dr. Gray as being "thick, about eleven inches long, tapering at each end." Subsequently he has received one of the stalks, or axes, of what I have named *Verrillia Blakei*; of the latter, he says it

is "long, slender, about sixty-four inches long, attenuated at the base, and very much attenuated and elongated at the other end." "Mr. Carter" examined both of the bones referred to, microscopically, and "finds them" to "present the same horny structure," etc. An examination with acid was made, but as it would be rather difficult to comprehend in what way generic or specific determinations within any related groups could be determined by *acid*, this test may be allowed to pass.

The reference of *Verrillia* to *Osteocella* as a synonyme, or otherwise, must rest on this microscopic test, as the soft investing portion of the animal, the perfect or complete polyp or polypidom of the Australian form, to which the bone, if the axis of an alcyonoid, belongs, and upon which Dr. Gray made his genus *Osteocella*, has not, as yet, been seen by him, or brought under scientific observation. He cannot aver, because he does not know, but that it may be a species which belongs to some genus already described, or that it may properly fall in as a sub-genus of some of the genera of Alcyonoids previously known; he does not know but what its relationship may be nearer to any of the other groups than to *Pavonaria*. No description sufficiently accurate to be worthy of consideration can be made from the axial rods or bones alone, of this class of animal forms, nor can species be satisfactorily determined without the fleshy portion; nor, in the present state of our knowledge, can the microscope determine these points.

In his genus *Osteocella*, which, it must be borne in mind, rests solely on the *naked* Australian bone or axis, which he says is "thick," "eleven inches long," as published in the British Museum Catalogue of *Pennatulidæ*, no information is furnished as to the soft investing portion, for the very good reason that it had not been seen by him; yet in the number of *Nature* last quoted, he speaks of "the complete polyp-mass," thus clothing his west Australian *Osteocella* with the fleshy covering of the west North-American *Verrillia*. So much for his generic synonymy. As to the species, the North-American form, as referred to by him, could not be definitely placed, by anything written by Dr. Gray prior to the date of my description.

This is a matter, not of personal pride, but of scientific accuracy; and scientific naturalists should not lose sight of, or be diverted from, this *sine qua non*, or palliate individual idiosyncracies which involve integrity, and which should not be allowed to pass without challenge or comment.

The following paper was presented by Dr. J. G. Cooper:

The Influence of Climate and Topography on our Trees.

BY J. G. COOPER, M. D.

While making geological explorations through the region embraced on the Bay Map, during some months past, for the purpose of completing the geological map, under direction of Prof. Whitney, I had unusual opportunities for

observing the distribution of the native trees in all kinds of localities, except the portions embraced in about fifteen miles square in the southeastern, and as much more of dry land in the northeastern corners of the "Bay Map Region."

On comparing my results with the series of careful observations on plant-distribution, given by Prof. Bolander, in our Proceedings, and Prof. Brewer, as given in the first volume of Geology of California, I have been able to arrive at the following interesting conclusions, tending to indicate the laws governing our tree-growth.

FORESTS AND TREES OF THE BAY MAP REGION.

In traveling around the Bay, the most notable fact in Botanical Geography likely to attract the observer's notice, is the comparative scarcity of the trees and small number of species, as compared with the regions either northward, at Russian River, or southward, at Monterey Bay. After careful study of the subject, the conclusion is inevitable that the chief cause of this deficiency is the prevalence of the strong winds, which, throughout the dry season, blow so steadily into the Golden Gate from the northwest, and are drawn by the ascent of heated currents far into the interior, following, generally, the course of the valleys *upward* from the Bay.

As to the prevalence of these winds, we have natural records of centuries past, in the trees themselves, bent almost to the ground in numerous places. Going beyond the vicinity of this Bay, we find a low tract of hills lying between Petaluma and Tomales Bay, where, for a distance of ten miles square, the Coast Range is depressed to an average height of three hundred and fifty feet, with passes through it only one hundred and fifty feet above the sea. Here, the winds blow inland with sufficient force to have limited the tree-growth to scattered groups on the eastern slopes of the hills.

That soils are only secondary in their influence, is shown well around this city, where every variety of metamorphic rock and tertiary sandstones occur, as well as abundant alluvium in the valleys. Much the same variety is seen in the low hills west of Petaluma, while other openings along the coast to the south, such as Salinas Valley, and those along the coast south of Ventura, (known to sailors as "Wind Gaps," on account of the strong sea-breezes drawn inland where they occur) all prove the prevalence of the same laws.

Elevation above the sea, of course, has some influence, but less than would be expected; for we find a large number of the forty species of trees found in these limits, growing with scarcely any difference in size or luxuriance, from the sea-level up to 4,500 feet. Others, however, show a preference for mountains or valleys alone, and all are influenced by the effect of the mountains in moderating the winds, intercepting fogs and rain-clouds, and producing more extreme degrees of cold and heat than prevail in the valleys. The studying out of all these influences, as relating to each species, would be a very slow process, and I need not attempt more now than to mention such as seem to have a peculiar effect on certain species. The general unfavorable influence of the absence of mountains on tree-growth in our climate, is shown by the usual bareness of our valleys, and of the lower hills, where unsheltered from the wind.

The trees are probably affected more by the wind than any other vegetation, on account of their height not permitting them to be sheltered behind hills which would protect shrubs or herbs. Thus we find some species becoming trees elsewhere, which, on the exposed portions of this peninsula, are only shrubs, as well as on some mountain ridges, assuming the aspect of trees stunted by the cold on Alpine summits. Dryness, however, is still more influential than cold, as seen in many inland localities, especially in the Chestnut, and some other species, which are lofty trees or stunted shrubs, according to their water supply. One shrub—not rare here—the Juneberry, (*Amelanchier alnifolia*) becomes a tree in the moister but cold climate of Montana. It is therefore inadvisable to include the shrubs and trees together; the former being influenced by quite different laws of distribution.

From the general course of the mountain ranges, being nearly northwest in this region, while the wind strikes their southwest slopes obliquely, and the sun in its daily course shines most intensely and longest upon the same exposure, it follows that this slope is almost everywhere destitute of trees, though along the coast exposed to the greatest rainfall and the most fog. The opposite, or northeast slopes, therefore, usually have the greatest tree-growth; though, in some cases, especially south of this latitude, they have less than the southeast, on account of the "drawing" of the wind up valleys, and upon them. Were it not for the "Tomales Wind Gap," we should doubtless find more species of trees growing in the shelter of Mount Tamalpais, thus approaching us nearer from the north than from the south, on account of this protection, and the greater rainfall northward. These winds seem to act in two ways: First; by their drying power; as seen in the absence of trees on slopes of hills exposed to them, while trees may abound on the opposite slope, though facing the south, and more exposed to the sun. Second; by their coolness not permitting the sun's heat to produce a tree-growth, even where moisture is abundant. This acts chiefly on the seedling tree, as many species are found to do well when planted out where they do not exist naturally, if protected when very young.*

The nature of the soil, or geological formation, influences them secondarily, and chiefly in proportion to the amount of moisture retained; flat, swampy lands, and impervious rocks covered by a deep soil, being most favorable. Many low lands, however, though very wet in winter, become too dry in summer. The summer fogs, also, have some influence.

From these facts, it results that the forests are chiefly most extensive on the northeastern mountain slopes, or those nearest the ocean, in exact proportion to their extent, altitude, and latitude.† The only tracts within our limits, which can properly be called forests, are: First; the tract covered by the Santa Cruz Mountains, of which about half is covered by coniferous trees, an area of about 1,080 square miles. Second; a tract of less than half this extent, northward

* The effect of wind in spreading fires in former dry seasons may also have had an influence in destroying ancient forests.

† The Sierra Nevada, from their greater altitude, catch the moisture passing east of the Coast Range on southwest slopes, while the sea-breeze does not affect them.

of Mount Tamalpais. Third; the oak-groves of San José Valley, covering about 250 square miles. Fourth; mixed groves of oaks and pines on the easterly slopes of the Contra Costa and Mount Hamilton Ranges. Fifth; similar groves on the ranges north of the Bay, forming the continuation of those mountains.

The modifications caused in the course and force of the wind by the various gaps referred to, are the chief causes of local peculiarities in the distribution of trees. The shelter afforded by the intervening mountain ranges, and by others, farther inland, together with the directions and width of the valleys, so modify the distribution of species, that instead of being in semi-circles concentric to the "Golden Gate," they are found to be arranged in semi-ellipses, with curves nearly parallel to that of an arc drawn from Point Reyes, through the Golden Gate, to Pigeon Point.

Of course, the general law of increase in number of species and individuals toward the north, in direct proportion to the increase of moisture, and their decrease toward the south and east (at the sea-level) from the contrary conditions, has its full effect in this region.

We thus have three primary groups of trees — the Northern, Southern, and Eastern; but within the limits mentioned, only two are exclusively northern, if, indeed, more than varieties of southern forms (*Cup. Macnabiana* and *Pinus contorta*). Those confined to the south are but three, of which two, the Grape and Sycamore, go north in the Sacramento Valley; while the Pine (*P. insignis*) has been confounded with northern forms, and may be only a local variety.

The Eastern Group contains four species, *Juglans rupestris*, *Juniperus*, (sp.) *Pinus Sabiniana*, and *P. Coulteri*, of which the second is a rare straggler; and the fourth closely allied to the third. To counterbalance this, is a group confined to the Coast, not found east of the Bay, consisting of four or five species: *Fraxinus Oregonus*, *Quercus chrysolepis*, *Torreya Californica*, and *Taxus brevifolia*; probably, also, *Cupressus macrocarpa*.

The remaining twenty-seven are found around three sides of the Bay, and, therefore, show most strongly the influence of the sea-breeze in limiting their approach to its mouth. Fourteen of these may be considered as scarcely limited by it at all, since they are found within the most windy portion wherever hills furnish a little shelter. From their adaptation to the extremes of our climate, they are characteristic of nearly all the mountain ranges of the Bay Region. The Fir alone is very rare east of the Bay; while the Willows and Poplars belong to low, wet grounds. Six, being broad-leaved evergreens, and one coniferous, show the characteristic proportion of those groups in a region almost without frost, but with very moderate summer heat. It is, however, to be observed, that nearly all of them flourish more luxuriantly where the summer is warmer, even if the winter be colder.

They are the following:

Group I.—Growing within ten miles of the center of San Francisco county:

1. **Ceanothus thyrsiflorus, *Esch.* Wild Lilac.**

2. Æsculus Californicus, *Nutt.* California Buckeye.
3. Cerasus ilicifolia, *Nutt.* Hollyleaved Plum.
4. Photinia arbutifolia, *Lindl.* Photinia Laurel.
5. Arbutus Menziesii, *Pursh.* Madroña.
6. Sambucus glauca, *Nutt.* Blueberried Elder.
7. Oreodaphne Californica, *Nees.* California Bay Tree.
8. Quercus agrifolia, *Nees.* Hollyleaved Live Oak.
9. Alnus viridis, *D. C.* Alder.
10. Salix lucida, *Muhl.* Shining Willow.
11. Salix longifolia, *Muhl.* Longleaved Willow.
12. Salix lasiolepis, *Beuth.* Wooly-scaled Willow.
13. Salix brachystachys, *Beuth.* Shortspiked Willow.
14. Populus monilifera, *Ait.* Cottonwood.
15. Tsuga Douglassii, *Lindl.* Red Fir.

Group II.—Found from ten to twenty miles from the center of San Francisco county:

16. Vitis Californica, *Benth.* California Grape.
17. Acer macrophyllum, *Pursh.* Large-leaved Maple.
18. Negundo aceroides, *Mœnch.* Box Elder.
19. Fraxinus Oregonus, *Nutt.* Oregon Ash.
20. Platanus racunosa, *Nutt.* Sycamore.
21. Quercus Gambelii, *Nutt.* Upland White Oak.
22. Quercus densiflora, *Hook.* Tan-bark Oak.
23. Castanea chrysophylla, *Dougl.* California Chestnut.
24. Pinus tuberculata, *Don.* Tubercled Pine.
25. Cupressus Macnabiana, *Murr.* Tamalpais Cypress.

Of these ten, only two are broad-leaved evergreens, and two, coniferæ, indicating increased additions from northern families; all of them belong to the mountainous districts, except, perhaps, the Ash, a rare tree in this region.

Group III.—Found twenty to thirty miles from the center of San Francisco county:

26. Juglans rupestris, *Engl.* California Walnut.
27. Quercus Sonomensis, *Beuth.* Black Oak.
28. Quercus lobata, *Nees.* Valley White Oak.
29. Populus tremuloides, *Mich.* American Aspen.
30. Pinus muricata, *Don.* Bishop Pine.
31. Pinus Sabiniana, *Dougl.* Digger's Pine.
32. Juniperus occidentalis? Western Juniper.
33. Torreya Californica, *Torr.* California Nutmeg.

Of these, all are deciduous, except the coniferæ, and are also mountain trees. Three are confined to the drier eastern ranges; one to the moist coast range; and the Aspen is a rare straggler from the north.

GROUP IV.—Found thirty to forty miles from the center of San Francisco county:

34. Quercus chrysolepis, *Lieb.* Gold-scaled Oak.
35. Pinus Coulteri, *Don.* Great-coned Pine.
36. Pinus ponderosa, *Dougl.* Yellow Pine.
37. Pinus insignis, *Dougl.* Monterey Pine.
38. Pinus contorta, *Dougl.* Twisted Pine.
39. Taxus brevifolia, *Nutt.* Oregon Yew.

Only one is a broad-leaved evergreen, replacing the common Live Oak on some of the drier mountains. Of the Pines, the first is confined to the dry, eastern hills; the second, rare, if found at all, on the Mount Hamilton Range, though common north and south, at forty miles distance. The third, is only found south; and the fourth, north.

GROUP V.—Found forty to sixty miles from San Francisco:

40. *Cupressus macrocarpa,* Hartw. Monterey Cypress.

This tree barely comes within the sixty-mile limit to the north, growing inland, near Mt. St. Helena, but southward, only near Monterey, as far as known; though a similar form occurs dwarfed on mountains as far south as Anaheim, where, at 2,000 feet elevation, it grows about four inches thick, and twenty feet high. At Cypress Point they grow four feet thick, and sixty, or more high, but flat-topped, and reduced in height by the winds. The influence of fogs and clouds seems more marked on the growth of this tree than on any other, though affecting the Redwood and Pines to some extent. The influence of peculiarities of climate and soil in producing some of the local forms of this genus now called species, will probably, in time, be determined by their cultivation together. A form, still undetermined, is found growing on Cedar Mountain, thirty-six miles east, apparently most like *C. Macnabiana.*

TREES FOUND OVER SIXTY MILES TO NORTH AND EAST.

Rhamnus Purshianus, *Hkr.* Bearwood.
Acer glabrum, *Torr.* Smooth Maple.
Acer circinatum, *Pursh.* Round-leaf Maple.
Cercis occidentalis, *Torr.* Western Judas Tree.
Pyrus rivularis, *Dougl.* Oregon Crab-apple.
Quercus Wislizeni, *Engl?* Wislizenus Oak.
Quercus Douglassi, *Hkr ?*=Q. Garryana?
Pinus Lambertiana, *Dougl.* Sugar Pine.
Picea grandis, *Dougl.* White Fir.
Abies Menziesii, *Dougl.* Black Fir.
Abies Mertensiana. Hemlock Spruce.
Thuja gigantea, *Nutt.* Oregon Cedar.
Cupressus Lawsoniana, *Murray.* Port Orford Cypress.
Libocedrus decurrens, *Torr.* California Cedar.

TREES FOUND OVER SIXTY MILES TO SOUTH AND EAST.

Cupressus Goveniana, *Hartw.* Goven's Cypress.
Picea bracteata. Leafy-cone Fir.
Quercus crassipocula. Thick-cup Oak.

Proposed amendments to the Constitution, submitted by Dr. Blake, were referred to the Trustees.

Regular Meeting, April 7th, 1874.

President in the Chair.

Fifty members present.

Manuel Aspiroz, Rev. Frederick E. Shearer, William C. Gibbs, Ferdinand Lantern, and George W. Dietzler were elected resident members.

Donations to the Museum: Dr. D. E. Hungerford presented a large collection, mostly from Lower California, consisting of about sixty species of shells, with many duplicates; specimens of *Gorgonia;* two specimens of Coral, one form new to the Academy's collection. Nine Star-fish, with several duplicates. Three specimens of fish (skeletons). Skull of wild cat (?). Two specimens of Crustacea (*Calappa*). Vertebræ of Shark. Six fine specimens of tortoise shell (*Caretta fimbriata*). Copper ore from near Loreto, Lower California. Steatite, from La Paz, Lower California. Fish-hooks used by Sandwich Islanders. Curious molluscan Egg-cases, with seven cigar boxes of duplicate shells. Dr. Marshall presented the cast of a Mastodon's tooth, from San Mateo. Captain D. C. Woods presented the snout of a Saw-fish, caught off the coast of Mexico, and a pair of Cow-Walrus tusks, taken from the animal at Cape East, Behring's Strait. Mr. W. G. Blunt presented a case of twenty-five species of eggs, named, with the localities. From F. Gruber, specimens of mounted birds, as follows: *Psittacula passerina*, or little green paroquet; *Cistotharus palustris*,

or long-billed marsh wren; *Turdus ustulatus*, or Oregon thrush; *Procnias ventralis*, or swallow-tailed fruit eater; *Icterus Jamaicaii*, Black-banded Troupiale; *Rhamphocelus Brasilica*, Crimson Tanajer. Judge Ford, through Barry & Patten, presented the Skull of a marine animal (not determined). J. W. Michael presented a fossil Sea Lion's skull, washed out of a clay bank on Chorro Creek, San Luis Obispo County, twelve miles from the coast. Six specimens of ore from Utah and Colorado were received, from Hon. Samuel Purdy. Henry Edwards presented specimens of scorpions, tarantulas, and lizards, collected on the Colorado River, Arizona. H. G. Bloomer donated a specimen of the Australian Carpet Snake. From Mr. Button, two alcoholic specimens of Lizards. A specimen of Tapa, or native cloth, from the Pacific Islands, varnished, and of a peculiar pattern, differing from any in the collection of the Academy, was received from Mr. Raymond. Mr. McHenry presented some fossil leaves, from Seattle, Washington Territory.

Dr. Behr exhibited and described the nature of a species of *mangrove*, (*Avicenus officinalis*) adapted to this State, and found in New Zealand. He had, after considerable difficulty, procured some of the seed in a perfect condition, and was experimenting in raising the tree. It is used to protect plantations against tides. The trees grow in the sea, as far out as the low-tide mark. The seeds are never dormant, but begin to germinate as soon as mature, whether in air, earth, or water. They always grow where not wanted, and do not always grow where they are wanted.

S. C. Hastings read a short paper on "Correlation of Forces, and the Indestructibility of Matter."

Reclamation of Swamp Lands.

BY CHAS. D. GIBBES, C. E.

The various modes by which swamp and overflowed lands may best be reclaimed and brought into a state of cultivation will of course depend on many circumstances, of which the nature of the soil is one of the chief considerations; also, the rise and fall of the tides, together with sluices of sufficient capacity properly placed to drain the land in the interior, at least eighteen inches below the general level of the surface. These are essential conditions, on which alone the work of reclamation can be commenced with any hope of success.

This subject divides itself into so many branches, minute in themselves, yet

each in its place important to the whole, that we can only give a few condensed remarks, in the hope of their being useful to those who are reclaiming, and to show some of the errors in the present manner of draining.

DRAINAGE.—The first thing to be examined is the difference of level between the interior of the land to be leveed, and the bank of the river or slough on which the dike is to be constructed; and in order to know the required depth of the ditch to enable it to keep the waters down to a level of 18 or 20 inches below the surface of the interior.

Frequently, however, one or more small sloughs extend into the interior, which are of great advantage, forming a natural reservoir and drain for discharging the surplus water at every low tide.

The difference in the level of the land is frequently two or three feet.

TIDES.—The next thing to be considered is the tides. In each lunar day of 24 h. 50 m., there are generally two high and two low tides, which are unequal in height and occur at unequal intervals.

In a series of observations on the tide, taken by me last summer on the coast in San Mateo County, the result of one day shows thus: Commencing at low water large, it rose 4.1 feet to high water small, then fell 1.7 to low water small, then rose again 1.3 feet to high water large, making a total rise 6.7 feet, then fell 7.5 to low water large.

Now, for some distance above the confluence of the Sacramento and San Joaquin Rivers, the greatest rise and fall of the tide is about 6 feet; high water small would average perhaps 3½ feet above low water large; and low water small about two feet above. A flood-gate at a level with the lowest water would be most of the time under water, and therefore afford but a very short run in the discharge of the water.

FLOOD GATES.—In the attempt to reclaim our tule lands, the flood gates have been a great source of trouble and expense, from the imperfect manner in which they are constructed and secured. In many places, no calculation having been made for the amount of pressure they have to sustain, they frequently give way, and the sluice box is sometimes canted with one end 4 or 5 feet lower than the other. The reason is evident. I speak now more particularly of the large sluices at the mouth of sloughs that are dammed; they have generally been made of an open box twenty or thirty feet in length, ten or twelve feet wide, and placed at the level of low tide; the levee being five or six feet high gives a gate, say ten feet wide, twelve feet deep, and three or four inches thick. This heavy gate, equal to about one-half a ton, is placed in the center of the box. Consider, now, what a loss of power a small body of water, perhaps only one or two feet in depth, has to raise the gate in discharging. But this is not the only error—we come now to the

PRESSURE OF WATER.—The weight of a cubic foot of fresh water is 62½ pounds. Water standing in an enclosure presses with equal force on the bottom and the sides at the junction, but the force on the sides will be in compound ratio of its depth. The pressure of a column of water a foot square and six feet deep = 375 pounds, but the side pressure = 1,312½ pounds.

Suppose we have an open sluice box twenty feet in length by ten feet wide with the gate in the center, 10x10 the square of the bottom outside of the gate = 100 square feet × 375 pounds = 37,500 pounds or 18¾ tons; and the pressure of each column, 1,312½ pounds, × 10 feet wide = 13,125 pounds or 6½ tons on the gate; width of water has no influence on side pressure.

Now, we generally find that these sluice boxes stand for some time until the water inside is reduced to the level of low tide, when there being no resistance on the inside of the gate to counteract the enormous pressure outside, it gives way gradually day by day, until at last it is not surprising that it sinks outside and cants up inside; particularly when there is is no sheet piling, only some inch or 1½ inch boards 6 or 7 feet long put in the mud and tacked on at each end.

The same case occurs with the dams unless made sufficiently strong to stand the pressure, which against a dam one hundred feet in length is at high tide about 65½ tons.

We have been referring to quiescent water; but in considering the force of waves driven by wind, the pressure of flood tides, or the strength of a strong current against the embankment or flood-gates, a large allowance must be made; it is scarcely possible, however, to reduce them to calculation, but we may safely add one-fourth to the pressur e.

Great care should therefore be taken in selecting a site for a dam or flood-gate, to avoid those spots that are exposed to any great currents or rush of tidal waters, particularly where a stream suddenly narrows, as there the tide comes up very strong; and also to its exposure with respect to the prevailing winds.

Where fresh-water swamp lands are adjacent to high land, catchwater drains should be made to intercept the upland or external waters and conduct them off to a separate outlet.

The small sluices from the ditches or drains inside of the levee should be placed, if possible, sufficiently above the ordinary low water to allow it to have five or six hours run between tide and tide, beginning at half ebb and continuing to half flood tide; if placed at low water, the gate would be shut sooner by return of tide, although so long as the weight of the water inside is greater, so long will it continue to run.

The best level, therefore, to afford the longest run, is probably between the mid-tide level and the lowest low water, or in fact as high as it will admit to drain the low land in the interior, 18 or 20 inches.

The trunk or box sluice has been used in the rice fields of South Carolina upwards of a hundred years, and has been found to answer better than any other. A good size for our use is about six feet wide by eighteen inches deep, with self-acting tide gates; if made of redwood, and put in properly, they would last a long time, stand firmer, and are not liable to be thrown out of level by the pressure of water. They should be put down while you are making the embankment, as it is useful in keeping the land drained, and so facilitates the work.

It is now more than twelve years since I furnished these plans to a gentleman on the San Joaquin, who found them to work well on his place.

The trunk dock connecting the outer end of the trunk with the river should be wider than the sluice-box, so as to allow the free egress of the water, and should also be deeper than low tide.

The flood-gates now being in place, we can proceed to build the

LEVEE.—The materials of which the embankment is to be constructed will govern in a great measure the other requisites to be attended to in its formation.

These materials differ essentially on the San Joaquin and Sacramento Rivers in different localities. On the San Joaquin, we generally find a sod or turf of a peaty formation, which shrinks when dry about one-third, becomes very light, and can either be burnt up or floated away; while on the Sacramento it is composed of two kinds. In some places the turf has a sedimentary deposit of clay, which makes it firmer, heavier, and not so liable to burn. In other places, the banks of the river are sandy, which is the most difficult material to manage, and the least to be depended on; it melts away like sugar in water.

The first consideration is to determine the height of the levee to keep out the ordinary summer freshets, but it will not answer to have the levee of the same level, for in certain places it will be found necessary to raise it; for instance, I examined the water marks of the flood of '71 and '72 on trees about a mile apart on the same island, where the bank was apparently the same height above ordinary tide, and found a difference of six to eight inches, which was caused by the confluence of two currents backing the water above.

Having determined the height that you wish to construct your levee, add at least one-fifth for shrinkage, and build it the proper height at once.

The distance from the ditch to the inner slope of the levee should be at least twelve or fifteen feet, and from the outer margin to the river not less than thirty feet, and in some cases more; but it will depend a great deal on the formation of the bank, exposure to currents and winds.

The inner slope should be 1½ to 1; and the outer slope not less than 3 to 1; or follow nature as far as possible, as the downward pressure of the water will assist to keep the levee in place, and the broader the base will enable it to resist the inward pressure, which, with a flood of five feet on the levee, will equal 45¾ tons on every hundred feet in length, without allowing for the force of the current or wind.

While the levee is yet wet, sow mesquit or bermuda grass seeds on it, either of which will form a good sod to protect and bind the levee together and prevent it from cracking; also, would form a good pasture for a few sheep or Angora goats.

Care should be exercised in running ditches into the interior; first, the ground should be examined that you do not cut through float land, second, to ascertain the level; for I have known a contract let to Chinamen to dig a ditch three feet deep, and when completed the water ran back and flooded the low land. Unless your levees and flood gates are properly constructed it is only a waste of money to attempt reclamation.

I would strongly urge the attention of the farmers in our swamp lands to

the cultivation of the upland rice. The yellow or golden rice is best adapted both to wet and dry culture. It produces from fifty to one hundred bushels of rough rice to the acre; prospers best on a level, sandy soil, inclined to moisture.

Bois d'Arc.—I would call attention also to the Bois d'arc, or Osage orange (*Maclura aurantiaca*). I have seen it in its native state, in the swamps of the Bois d'arc fork of Trinity River, Texas, where it grows to the height of sixty or seventy feet, with a diameter of two or three feet, and is one of the most beautiful of the native trees; the wood is one of the most durable in the world, and is remarkably strong, elastic, and tough; of a beautiful yellow color, close grain, receiving the finest polish, making it valuable for furniture, and is used in Texas for wagon wheels, as not liable to shrink. For ship-building, it is esteemed preferable to live oak; and by the Indians is preferred for bows to all other woods. It also yields a yellow dye. For an ornamental tree, it is most graceful, with its dark green foliage, hard smooth bark, drooping branches, and large orange-colored fruit.

It forms a good belt or hedge row for sheltering gardens, vineyards, or orchards, is of a rapid growth, and has formidable thorns for hedges. A plantation of Osage orange, set out now, would in a few years afford most valuable timber, that would pay well; and sprouts grow rapidly from the stumps, soon renewing the timber cut.

Notes on some Tertiary Fossils from the California Coast, with a List of the Species obtained from a Well at San Diego, California, with Descriptions of two New Species.*

BY W. H. DALL, U. S. COAST SURVEY.

The following list comprises the majority of the forms presented by Mr. Hemphill to the Academy, which were collected by him from the *débris* brought up in sinking a well at San Diego. Most of them are from a depth of 140 to 160 feet below the surface. They are generally in very good preservation, the matrix being a fine sand, in some cases hardly consolidated at all, and in others quite hard from infiltration of lime and other minerals.

The important bearing which the careful determination of all our tertiary fossils has on questions of the present and past geographical distribution of the mollusca, I need hardly impress on the attention of the Academy:

1. *Glottidia albida*, Dall ex Hinds.
2. *Xylotrya*, sp. indet. Tube only.
3. *Cryptomya Californica*, Conr.
4. *Solen rosaceus*, Cpr.
5. *Solecurtus Californianus*, Conr.
6. *Macoma* (var.?) *expansa*, Cpr.
7. *Callista*, sp. indet. Smooth, inflated, thin; much like *Callista Newcombiana*, erroneously described as *Lioconcha* by Gabb.

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*Printed in advance, March 26th, 1874.

8. *Cardium centifilosum*, Cpr.
9. *Venericardia borealis*, Conr.
10. *Lucina Nuttallii*, Conr.
11. *Lucina borealis*, Linn.
12. *Lucina tenuisculpta*, Cpr.
13. *Cryptodon flexuosus*, Mont.
14. *Modiola recta*, Conr.
15. *Arca microdonta*, Conr.
16. *Nucula*, sp. n. according to Dr. Cooper; named in MSS. by Carpenter. Looks much like *N. tenuis*.
17. *Acila Lyallii*, Baird. This species has been frequently reported as *castrensis*, Hds.
18. *Leda coelata*, Hinds.
19. *Pecten hastatus*, Sby.
20. *Amusium caurinum*, Gld.
21. *Janira florida*, Hds.
22. *Ostrea conchaphila*, Cpr.
23. *Placunanomia macroschisma*, Desh.
24. *Tornatina eximia*, Baird.
25. *Cylichna cylindracea*, Linn.
26. *Dentalium hexagonum*, Sby.
27. *Dentalium semipolitum*, B. and S.
28. *Siphonodentalium pusillum* (?), Gabb.
29. *Calliostoma annulatum*, Mart.
30. *Galerus filosus*, Gabb, as *Trochita*.
31. *Crepidula navicelloides*, Nutt.
32. *Crepidula princeps*, Conr. This is not *grandis* of Midd.
33. *Turritella Jewettii*, Cpr.
34. *Bittium asperum*, Cpr.
35. *Myurella simplex*, Cpr.
36–39. *Drillia*, sp. indet. This and three other forms of *Drillia* so closely resemble Gulf forms, that it is inadvisable to describe them without a comparison of specimens.
40. *Surcula Carpenteriana*, Gabb, and variety *Tryoniana*, can hardly be separated as species. The transition is very gradual and complete.
41. *Mangelia variegata*, Cpr.
42–45. *Mangelia*, spp. indet. The same remark applies here as to No. 36.
46. *Clathurella Conradiana*, Gabb. The specimens are slightly stouter than Gabb's figure, but vary among themselves in this respect, and in other characters are similar to his species.
47. *Odostomia straminea*, Cpr. var.
48. *Odostomia*, sp. indet. Very imperfect.
49. *Chemnitzia torquata*, Cpr.
50. *Eulima rutila*, Cpr.
51. *Scalaria subcoronata*, Cpr.
52–55. *Cancellaria*, 4 spp. indet. Most of them, as far as memory serves, resemble southern forms not at hand for comparison.
56. *Neverita Recluziana*, Petit.

57. *Sigaretus debilis*, Gld.
58. *Ranella Mathewsonii*, Gabb.
59. *Olivella bætica*, Cpr.
60. *Nassa fossata*, Gld.
61. *Nassa mendica*, Gld.
62. *Astyris tuberosa*, Cpr.
63. *Astyris*, sp. indet. jun.
64. *Ocinebra lurida*, Cpr.
65. *Pteronotus festivus*, Hinds.
66. *Trophon orpheus*, Gld.
67. *Fusus* (*Colus*) *Dupetit-Thouarsi?* Kien.
68. *Chrysodomus*, n. s. Too imperfect for description, but very distinct; perhaps a *Volutopsis*, as the nucleus would indicate.
69. *Chrysodomus Diegoënsis*, n. s.

Shell large, solid, fusiform; apparently, when fresh, of a brownish yellow color; sculpture consisting of regular, even, rounded. spiral ridges, slightly larger toward the anterior end of the last whorl, with from two to four sharp grooves intercalated between each two of the primary ridges, forming fine and small secondary threads of spiral sculpture. On the posterior whorls these are crossed by slightly oblique waves or plications, evanescent toward the sutures and strongest on the apical whorls. On the last whorl and a half these are absent. The posterior fourth of the whorls slightly impressed and the sutures appressed. Whorls eight and a half, periphery rounded. Canal short, recurved, siphonal fasciole short and strong. Outer lip slightly thickened behind the edge, inner lip covered with an even callus. Columella smooth, slightly arched; throat with internal sharp threads, as in *C. dirus*, ending some distance behind the edge of the outer lip.

Length, 4.0 inches; width, 1.75 inches. Length of aperture, 1.8 inches. Deflection, 42°.

The upper whorls of this shell bear a slight resemblance to *Siphonalia Kellettii;* though the transverse waves are very different from the knobs of that species. There appears to be no special reason for referring the present form to *Siphonalia*, while it presents so great a resemblance to many *Chrysodomi*.

Habitat, with other tertiary fossils, in a sand-bed cut through by a well-shaft, at San Diego, California, at a depth below the surface of about one hundred and fifty feet.

Besides these are several small bivalves, which belong to different species; but the specimens are too imperfect for description, or even recognition.

On an examination of the list it will be seen, that of sixty-nine specimens only three are strictly Miocene, while many are reported by Gabb as extending from the Miocene to the present epoch. Of fifteen indeterminate species, some will probably prove to be new, though I have only felt justified in describing one species, from the lack of specimens for comparison.

The age of the deposit, in general terms, may be taken as Pliocene; though it is evident that the different epochs of the Tertiary are not as sharply separated on this coast as in some other parts of the world.

Among a number of Tertiary fossils from Cerros Island, Lower California, presented to the Academy by Lieut.-Commander Kennedy, of the U. S. C. S. steamer *Hassler*, are a number of brachiopods. These vary very widely in form and sculpture, some being ovoid and perfectly smooth, except for lines of growth, while others are much more transverse, and provided with radiating ribs varying in number and strength. The extreme forms appear very distinct; yet, so perfectly is the transition expressed in the large number of specimens before me, that I cannot consider them as forming more than one species. In most of them an internal septum is evident externally through the shell, indicating that they belong to the genus *Waldheimia*. This is rendered certain by an examination which I made of the interior of several specimens, and in which I discovered the loop, more or less injured, but unmistakably that of a *Waldheimia*. Having submitted specimens to Thomas Davidson, F.R.S., of Brighton, England—the most eminent authority on fossil brachiopoda—he has kindly informed me that he considers the species to be new. The following description will serve to characterize it:

Waldheimia Kennedyi, n. s.

Shell solid, ovoid to transverse in form, moderately inflated; surface roughened by lines of growth, occasionally forming slight ridges; generally furnished with radiating, rounded ribs, growing coarser toward the margin, but in some instances totally destitute of them. These ribs may be as few as six in number, and very coarse; or may be much more numerous, and nearly evanescent, which is the usual form. The perfectly smooth ones are less common. The anterior margin of the valves is more or less flexuous, the convexity being in the neural valve. The beak is prominent, and much recurved, usually rather short. The foramen, when not broken or eroded, is small, and closed below by very small deltidia, which are usually lost or broken away. The area is ill defined, except in the most transverse specimens, and is marked by two and sometimes three grooves radiating toward the hinge margin from the foramen. The internal septum extends from one-third to one-half the distance from the hinge margin to the anterior edge of the hæmal valve. The cardinal border is strongly arched. The cardinal teeth are stout and short, and there are no pits behind or below them. The dimensions of one of the most transverse specimens are as follows:

Lon., 1.10 in. Lon. of hæmal valve, 0.97 in. Lat., 1.15 in. Diameter, 0.65; while one of extreme ovoid form measures as follows: Lon., 1.15 in.; of hæmal valve, 1.03 in.; lat., 1.10 in.; diameter, 0.83 in.

Habitat, in beds of Miocene age, Cerros Island, Lower California, associated with *Ostrea Veatchii*, Gabb, and *O. gallus*, Val., *Pecten subnodosus*, var. *Veatchii*, Gabb, and *P. Cerrosensis*, Gabb.

Dr. Gibbons made some brief allusions to the reported volcanic action at Bald Mountain, which, he believed, was the result of chemical actions, similar to those at our own Geysers.

The Corresponding Secretary read a circular from the Agassiz Memorial Committee, urging scientific men everywhere to assist in placing the museum founded by Agassiz on a permanent financial footing.

Some discussion ensued concerning the preparation of a new Constitution, and a resolution was adopted authorizing the Trustees to select such assistance, from the Academy at large, as they thought proper, and prepare a Constitution, to be presented to the Academy within six months from date.

Regular Meeting, April 20th, 1874.

Vice President in the Chair.

The election of new members was postponed until the next meeting.

Donations to the Museum: Dr. George W. Woods, Surgeon U. S. Navy, presented through his brother, I. C. Woods, the following articles, which were collected during four years' cruising in our naval vessels in the Pacific Ocean: Ball of Sennit, made from cocoanut fiber, from Ponape, Ascension Island; Mat made from banana leaf, from Mulgrave Island, Atoll of Milii; Belt made from banana leaf, from Mulgrave Island, Atoll of Milii; Matting made from the leaf of the banana, from Ponape, Ascension Island; Rope made from cocoanut, covered with banana fiber, from Mulgrave Island, Atoll of Milii; Cocoanuts for carrying water, from Ponape, Ascension Island; Head decorations, from Navigator Islands; Belts made from banana leaf, woven in native loom, from Caroline Group; Belts made from banana leaf, woven in native loom, worn by the chiefs of Ponape, Ascension Island; Neck decorations, from Butari Tari, Marshall Islands; Grass skirt, from Ponape, Ascension Island, made from banana leaf, worn by the females of all the islands of Micronesia, except the Marshall group; Bustle, worn with the grass skirt, by the males of Mulgrave Island, Atoll

of Milii; Grass skirt made of pandannus leaf, worn over bustle, by the males of Mulgrave Island, Atoll of Milii; Suit of armor, made from fiber of the cocoanut, from Island of Apaiaing, Gilbert group, Micronesia; Head-dress, from Ponape, Ascension Island; Head-dress, from Mulgrave Island, Atoll of Milii; Fish-hooks made from pearl oyster shell, Mulgrave Island, Atoll of Milii; Neck Decorations of Shells, from Mulgrave Island, Atoll of Milii; Two Bats, from Kusai, or Strong's Island, Caroline group; Head-scratcher, from Marshall Island, worn over the ear; "Kawa" cup, from Council House, Island of Ascension—the Kawa is chewed in the mouths of young girls, expectorated into these cups, where it ferments, becomes intoxicating, and is drank by the men in their revels; Water-dipper made from the bill of an Aquatic bird, from northwest coast of America; Basket, from Puget Sound, made by the natives; Model of a Canoe, from Neah Bay.

From E. Gruber, the following birds (stuffed): Mussel Thrush, (*Turdus viscivorus*) Chestnut-back Titmouse, (*Parus rufescens*) Black-cap Titmouse, (*Paraus ater*) Chaffinch, (*Fringilla cœlebs*) Pied Wagtail, (*Motacilla alba*) House Sparrow, (*Passer domesticus*) Bay-breasted Warbler, (*Dendroica castanea*) Song Thrush, (*Turdus musicus*).

From J. C. Merrill & Co., a collection of fishing implements, lines, bows, bundle of arrows, and a rock with a polished groove, supposed to have been used for sharpening spears and other implements, from the South Pacific Islands.

From W. W. Russel, a cluster of Barnacles, from bottom of ship *Miliceti*, after a voyage of six months and three days, from Bombay to Liverpool. Thirteen tons of these barnacles were taken from the bottom of the ship. Also, from same gentleman a Rock-boring Mollusca, from the Choumagin Islands; also, Egg of small black terrapin.

From E. F. Lorquin, rare specimen of Crab, (*Loxorhynchus grandis*, Stimpson) from Santa Barbara.

W. N. Lockington presented a specimen of *Cancer magister* of Dana, the common edible crab of San Francisco; *Palinurus interruptus*, the crawfish of the markets; two species of *Orchestia*, or sandhoppers; two species of lizards; a fresh water salamander;

a curious insect found running on dry sand, among the debris left by the tide near Fort Point.

Donations to the Library: Monatsbericht der Konig. Preuss. Akad. Wissenschaften zu Berlin, May, 1873, and Jan. 1874; Archiv fur Naturgeschichte Viertes Heft, Berlin, 1873; Canadian Naturalist, Vol. VII., No. 4, Montreal, 1874; American Naturalist, April, 1874; California Horticulturist, April, 1874; Nature, Vol. IX., Nos. 228, 229; Popular Science Monthly, April; American Journal of Science and Art, April, 1874; Descriptive Catalogue of Photographs of the U. S. Geological Survey of the Territories, 1869 and 1873; Bulletin Minnesota Acad. Nat. Science, 1874; Proc. Acad. Nat. Sciences of Philadelphia, Oct., Nov., and Dec., 1873; Engineering and Mining Journal, Nos. 12, 13, 14, and 15, Vol. XVII.; Bulletin of the U. S. Geological and Geographical Survey of the Territories, No. 2, Washington, D. C., 1870.

Dr. Fourgeaud read a paper entitled "General scientific hypothesis, as an introduction to a work on evolution of the organic and inorganic world." A resolution was passed by the Academy, requesting Dr. Fourgeaud to deliver a copy of his paper to the Secretary, so that the matter will not be lost, if not published in the contemplated work.

The following is an abstract of a paper read:

On Shell Mounds in Oakland, California.

BY A. S. HUDSON, M. D.

Some two miles north of the City Hall, Oakland, on the shore of the bay, are conspicuous two tumuli, which are composed of shells. They are situated on a low, level tract of alluvial land. On one of these, which is some 300 feet in diameter at base, the welling house of Mr. W. stands, surrounded with shrubbery. The shells are so much decayed on the surface, that plants and trees find perpetual moisture and grow without irrigation. A well 30 feet deep sunk in this ancient pile passed through a layer of shells 12 feet deep before the native black soil was reached. A vault dug 10 feet went through shells interpersed with layers of ashes and charcoal. Back and west of the house is a bold tumulus of more strength of feature. It is within a few yards of the shore of the bay; the shore or west side of the mound is thickly belted with willow trees. No deep exploration into this mound has been made,,but it seems composed wholly of shells, a few animal bones, and occasional fragments of charcoal. It it 240 feet in diameter at the base and circular in shape, truncated at the summit, which is 150 feet in diameter. Without accurate measurement, it is estimated to be 35 to 40 feet high. From the north side runs an arm or a kind of pan-handle, 270 feet long, and originally 5 or 6 feet high. About two feet of the surface of this pan-handle has been scraped off by the

proprietor of the land, to fill up a "pond hole" which lay immediately at the east side of it. A few human bones, and some mortars and pestles, were exhumed by the plow and scraper.

The mound now occupied for a dwelling-place is analagous to the kitchen-middens of Denmark. Not so with the neighboring tumulus, which evinces design. The pyramidal mound—represented in the accompaning sketch—cannot be looked upon as the result of accident. It is as shapely in outline as a well laid pile of brick or stone. Abbe Domenech, who spent seven years among the aboriginal inhabitants of the Pacific, says: "Indians do no special work for mere whim or pastime—they have a definite object in their labor." This mound bespeaks a similar sentiment. It conveys the idea that human hands gave it existence and figure, for a purpose. That purpose may have been for an oratory, for sacrificial customs, or feasts for the tribal chiefs.

Dr. Gibbons called the attention of the Academy to some potatoes, which had grown from last year's crop, coming to maturity this year, without throwing up any shoots above ground. He stated that last year he communicated the fact to the Academy, that in the spring of the year some potatoes were found in the ground, the tubers having apparently developed during the winter, without a stem. In Dr. Gibbons' garden there are now quite a number of different sized potatoes of recent formation, without stems, or with very little stem. How they got into the earth and how they were produced is the question. Last summer there were small potatoes left in the ground from the growth of the season. During the winter they probably passed into maturity, until they had attained the size of an egg and larger, when they throw up a stem. It is a strange fact in vegetable economy, if not in agriculture. I recently noticed a statement concerning volunteer potatoes, perhaps like these, to the effect that they were watery. These, though large, are not very good. As soon as they begin to throw up a shoot, they stop growing. It then takes the place of a tuber and throws out roots.

Mr. Gibbes announced that Major Sparrow Purdy, a corresponding member of the Academy, now at the head of a large expedition in Upper Egypt, had been making an extensive collection of curiosities for the museum of the Academy. Major Purdy may be able to ship his collection so that it will arrive in August.

Regular Meeting, May 4th, 1874.

Vice-President in the Chair.

Fifty members present.

The following gentlemen were elected resident members: Robert C. Rogers, Solomon Heydenfeldt, Jr., William C. Randolph, William T. Reilly, Dr. W. J. Younger, G. W. Anthony, Stephen H. Phillips, B. B. Redding, T. J. Lowry, J. Stephen Jones, William Brooks, W. C. Burnett.

Dr. D. E. Hungerford was elected a corresponding member.

Donations to the museum: Specimen of Spanish moss, presented by Mrs. Richard Chenery. Piece of Tapa cloth, presented by Mrs. Bridges.

Donations to the Library: From Mrs. Bridges, ancient book, printed in the Spanish language, published at Lima. Bulletin Essex Institute, Vol. VI., Nos. 1 and 2, Salem, Mass., 1874. Proceedings Boston Society Natural History, Vol. XVI, Part II, June, 1873, Jan. 1874. Bulletin of Buffalo Society of Natural Sciences, Vol. I, No. 4. Quarterly Journal of Microscopical Society, London, 1874. Annals and Magazine of Natural History, London, April, 1874. Annalen der Physik und Chemie, Leipzig, 1874. Astronomical Register, No. 136, London, 1874. Journal of Botany, London, April, 1874. Société Entomologique de Belgique. Proceedings, No. 97, Brussels, 1874. Nature, Vol. IX., Nos. 227, 230, and 231; American Chemist, Vol. IV., No. 10, Phila., April 1874. Bulletin Essex Institute, Vol. V, Nos. 11 and 12, Salem, 1873. Société Entomologique de Belgique, No. 96. Scientific papers by Isaac Lea, 8vo., Phila., 1874. Twenty-first Annual Report Mercantile Library Association. Astronomical Register, March, 1874. Journal of Botany, March, 1874. Annals and Magazine of Natural History, March, 1874. California Horticulturist, 1874. Overland Monthly for April, 1874. American Chemist, March, 1874. Monatsbericht der König Preuss Akad. der Wissenschaften zu Berlin, Dec., 1873. Report of State Board of Health for years 1871–2–3, from A. B. Stout.

S. C. Hastings read a paper "On the alleged mysterious occurrences at the Clarke mansion, in Oakland."

Mr. J. P. Dameron made some verbal remarks on radiates.

Dr. Fourgeaud read a continuation of his paper, read at the preceding meeting.

Rev. Albert Williams and Mr. Bloomer took exceptions to some assertions in Dr. Fourgeaud's paper, and after some discussion on the subject, the Academy adjourned.

Regular Meeting, May 18th, 1874.

Vice-President in the Chair.

Fifty-three members present.

Rev. E. L. Greene and Robt. T. Van Norden were elected resident members.

Donations to the Museum: Prof. Bolander donated a valuable collection, embracing two packages of plants from the Cape of Good Hope, and four packages from Europe, all identified and labeled. G. W. Michael, Jr., presented silicious petrifications of roots, from San Luis Obispo County. S. R. Throckmorton presented a specimen of *Rhinobatus productus*, caught in the bay off Black Point. This fish is described by Dr. Ayres in the second volume of the Proceedings of the Academy. Henry Edwards presented twenty-six specimens of crustacea, from the coast of Mexico. A specimen of petrified oak, found 100 feet below the surface, at Dutch Flat, was presented by a member.

Donations to the Library: Transactions of the Academy of Sciences of St. Louis, Vol. III, No. 1, 1873. Statistisches Jahrbuck der Stadt Pest Erster Jahrgang, Pest. 1873. Viehrzenter Bericht der Oberheisischen Gesellchaft fiër Natur und Heilkunde, Geissen, Apl. 1873. The Ancient Vessel found in Norway, Christiana, 1872. Manuel Elementaire de l'Art Heraldique, par Madame M***, Brussels, 1840. Notions Elementaires des Sciences Naturelles, etc., in 3 parts, par Chas. Morren, 12mo., Tieze, 1822. Palines et Couromnes de l'Horticultural de Belgique, etc., par Chas. Morren, Liege, 1851. La Maladie Actuelle des Pommes de Terre, etc., par Chas. Morren, Paris, 1845. No-

tice sur Chas. Morren, par Ed. Morren, 12mo. Bruxelles, 1860. Rapport Seculaire sur les Travaux de Botanique, 1772—1872, 8vo., par Ed. Morren. L'Horticulture a l'Exposition Universelle de Paris de 1867, par Ed. Morren. Bruxelles, 1870. Memorial der Naturaliste et au Cultivateur, par Ed. Morren et Andre de Vos, 8vo., Liege, 1872.

In addition to the usual exchanges, seven volumes of the "Phytologist," a standard botanical work, were added, by purchase, to the Library.

Dr. Fourgeaud read a paper on "Some of the relations of matter and space."

Dr. Fourgeaud also read a paper in reply to the exceptions taken by members to certain statements made by him in a paper read at the meeting of May 4th, 1874.

S. C. Hastings read a paper "On Electrical Phenomena on this Coast."

A member submitted for inspection shells of the Eastern transplanted oyster, which were covered with the spat of young oysters. It was a question whether the spat was that of the native California oyster or the propagation of the transplanted bivalve, and oystermen, whom he had consulted, were unable to determine the point. Mr. Throckmorton, State Commissioner of Fisheries, stated that he had investigated the matter, and found that the spat was that of the California oyster. It was found on the shells of Eastern oysters only where they had been transplanted in the vicinity of native beds. As yet, the Eastern oyster had developed no tendency to increase in these waters. They were short-lived here, becoming very fat, and dying within a year after being placed in the bay. . The experiment of transplanting Eastern oysters thus far has been a failure.

Regular Meeting, June 1st, 1874.

Vice-President in the Chair.

Forty-five members present.

John H. Saunders, G. Parker Cummings, and Wm. Dutch were elected resident members.

Donations to the Museum: A collection of ancient pottery, the specimens artistically wrought and perfectly preserved, was exhibited. The Vice President stated that the collection had lately been consigned to him for the Academy, but no communication in reference thereto had yet reached him. It was believed that the specimens came from Peru, and had been sent by Benjamin Smith or James Freeborn, two members of the Academy who are now traveling in South America. W. H. Turner presented the pupa of a large species of beetle, native of Mexico. Mr. Chapman presented specimen of Suisun marble. W. N. Lockington donated three cases of insects. D. W. C. Gaskell, of Forbestown, left on exhibition remarkably well-preserved teeth of the mastodon; also, tusk of a fossil elephant, found at New York Flat, Yuba County, found in auriferous gravel, on the bedrock, fifteen feet below the surface.

Donations to the Library: George C. Hickox presented an antique volume entitled, "A Catalogue and Description of the Natural and Artificial Rarities belonging to the Royal Society, and Preserved at Gresham College, by Nehemiah Grew, M.D., Fellow of the Royal Society and of the College of Physicians, London. Printed by W. Rawlins for the author, 1681."

Improved Method of Observing Altitudes of the Sun at Sea.

BY T. J. LOWRY, U. S. COAST SURVEY.

The science and art of navigation stand among the proudest achievements of modern thought and research. The accurate determination of the places of the fixed stars, and of the motion and position of the members of the solar system, gave the navigator numerous well determined points for observation. But the attainment of a corresponding perfection in fashioning instruments has ever baffled human skill, and ever will. For although we are entitled to look for wonders at the hands of the artist, we cannot expect miracles! And we hence see that the demands of the astronomer, and even the nautical astronomer or navigator, will always surpass the power of the instrument maker. They must therefore so combine their observations, so familiarize themselves with all the causes which may produce instrumental derangement, and with all the peculiarities of structure and material of each instrument used, as not to allow themselves to be misled by its errors, but to extract from their indications all that is true and reject all that is erroneous.

It is true that the astronomer can so weigh his observations in the balance of

the method of least squares, and so thoroughly sift them by Pierce's criterion, that hardly the trace of a large error remains; and the more minute errors, being casual and accidental, sometimes lie one way, sometimes the other; sometimes diminishing and sometimes tending to increase the results. And, inasmuch as the theory of probabilities tells us that these accidental errors are as liable to lie one way as the other, we hence have but to greatly multiply our observations under varied circumstances and take the mean or average of the results obtained, and we have this class of errors so far subdued, by thus setting them to destroying one another, that they no longer sensibly vitiate our practical results.

This principle of repetition, though so simple in theory and so beautiful in practice, when the instrument and observer are upon a firm basis, utterly fails of application where the observer and his instrument are tossed alike on the ocean's wave, and the object observed is "on wing." It becomes therefore imperative upon the navigator, if he would trace accurately his ship's path over the trackless ocean, that he attain rigorous correctness in the results of "each" of his instrumental measurements; and to this end, his constant care and vigilance must be directed to the detection and compensation of errors, either by annihilating or taking account of and allowing for them. This latter method of taking account of and allowing for errors, is that ordinarily pursued by the navigator; but it has navigated so many noble ships to the bottom of the sea, that the voice of humanity and the interests of commerce alike demand such a modification of the methods of observation, and the forms of the instruments, as to annihilate effectually and alike errors inherent in the observer, in the instrument, and in the atmosphere.

In the method of taking observations now generally practiced by the navigator, instrumental adjustments, atmospheric refraction, and the impressibility of the optic nerve, are all depended upon as constant and invariable during the observations; while, in fact, they all are ever fluctuating. The ever-varying fluctuations of heat and cold are continually changing the amount of atmospheric refraction, as also that of every instrumental adjustment. And it is a well known fact in optics that the irradiation (which causes bright objects to appear larger than they really are) varies with the length of time during which we look upon the object, during the first few moments of observation gradually decreasing; and then, as the optic nerve becomes fatigued, the optical illusion (irradiation) reappears magnified ten-fold. These are not mere speculative sources of errors, but practical annoyances, which every observer has to contend with—the incompetent navigator, of course, slurring them over as refinements too delicate to deal with, while he attributes the error thus introduced into his position to the action of imaginary ocean currents; but the thorough navigator meets these errors fairly, and sets about annihilating them. Yet it may be interesting to those navigators who insist on neglecting these finer instrumental errors, to know that very many of the sextants used in navigating vessels have an eccentricity ranging from one to four minutes, which is often aggravated by parallax of index-glass; and his positions are vitiated to the full extent of these neglected errors.

By the ordinary method of observing successive contacts of the opposing limbs of the sun with the horizon, even if the mind from one observation to the other retains fresh and full the vision of the contact, still the observer will fail to make the contact of the horizon with the perimeter of the sun at equal distances from its center, because he makes these contacts at different instants of time, when the eye is differently affected by irradiation and fatigue. And hence, what would appear one moment a delicate contact, would one minute afterward be wide of the mark. And thus it is, in the observations thus made with an instrument that is varying, with a vision that is varying, and through an atmosphere that is varying, we can clearly see the source of the errors which have lured many an unsuspecting ship fatally onward against rocks and reefs.

By the method which I now propose, and with the form of instrument herein designated, we avoid in part, and in the remainder essentially annihilate, these most fruitful sources of errors. By placing within the instrument itself the means of self-correction, we have the most effectual checks upon its errors of construction and the changes of its adjustments. Thus, from very simple geometrical considerations, it may be easily shown that the errors of eccentricity and of graduation are totally eliminated by the mean of the readings of two verniers 180 deg. apart, and by measuring the angles on different parts of the arc; and by using an index-glass susceptible of reversal between the parts of a set of observations, we banish every trace of error from parallax of index-glass from our results. And every error of observation—such as arise, for example, from inexpertness, defective vision, slowness in seizing the exact instant of occurrence of a phenomenon, and from atmospheric indistinctness, and insufficient optical power in the instrument—are all alike essentially checked by observing the contacts of the two opposing limbs of the sun with the horizon *at the same instant.*

Now, since we have the contacts of the upper and lower limbs of the sun in the field of view at the same moment, we have before our eyes a most thorough check on the character of the contacts, since by direct and instantaneous optical comparison we make each of them equally well. And, moreover, since we make the contacts of both limbs of the sun with the horizon at the same instant, we have in "each sight" an altitude, complete in itself, without the aid of a supposition of the constancy of atmospheric refraction, or the stability of instrumental adjustments, or the constancy of the impressibility of the optic nerve, or the aid of memory.

But, as we cannot measure what we cannot see, it is obvious that by the ordinary method of successive single contacts, those errors, too minute for low optical powers, enter and vitiate the results to their full extent. But by this method of double contacts at the same instant, we detect and avoid these errors, which would otherwise elude our vision. As for example, suppose we make what appears to be a contact of the upper limb of the sun with the horizon, and then by glancing at the other contact, of the lower limb and the horizon, in the same field of view, it will appear a contact equally nice as the other, if the first contact was exact, but if it was at all *in error*, then the second will be in error *twice* as much as the first; and thus it is *by doubling these errors,*

which the eye cannot discern nor the touch perceive, are we *enabled to sift them from our observations.* Still, the observer should use the most powerful telescope available. The improvement which I now propose, (besides a few other matters of detail) in the ordinary reflecting angular instruments, is a device for *duplicating the image of an object* by optical means.

This I accomplish by fixing an extra index-glass directly above, or in the same plane with that of the ordinary one of the reflecting repeating circle, and at an angle therewith equal to the apparent semi-diameter of the sun; or perhaps, a more complete solution of the problem, is to fix a small sphere of Iceland spar on the direct line between the index and horizon glasses, (see Fig. No. 1) and thus obtain two images of the sun equally distinct (see *s s'*, Fig. No. 4). This sphere to be mounted in a light metallic frame, so connected with a micrometer that its most delicate movements can be read off. In Fig. No. 2, *a* is the sun, and *b* its duplicated image, as seen in the horizon glass; and *b* is this same duplicated image brought in contact with the horizon; *c* is the position of the observer. Now, in observing, it makes but little difference whether these duplicated images are exactly tangent, slightly overlapping, or slightly separated, (as shown at *d*, *f*, and *e*, in Fig. No. 4) for in the first case we have but to bring the horizon to the point of tangency; in the second, to bisect the two exterior angles; or in the third, to bisect the space between the adjacent limbs of the sun. It is obvious that this method of observing the contacts of both limbs of the sun at the same instant is equally well adapted for double altitudes; the appearance of the images then is shown at *m*, in Fig. No. 4. Other improvements which I have devised are: 1st. A reversable double reflecting index-glass, (see Fig. No. 3) which eliminates the error due to its parallax; and 2d, making both faces of index-glass reflectors, and fixing a glass prism, with silvered hypothenuse, on the line of sight behind the index-glass, and at such an angle as to reflect the rays first reflected from the back face of index glass parallel to the line of sight. This device enables us to measure any angle (shown in Fig. No. 1). It is obvious that any two-angle reflecting instrument may also be made to give this duplication of images; and also give an altitude and its supplement at the same instant, and thus give us the algebraic sum of the existing refraction and dip. These improvements are all equally adapted and easily applied to any reflecting angular instrument.

By making these attachments to the French reflecting, repeating circle, (see Fig. No. 1) we have an instrument capable of not only eliminating its own errors, but those of observation, as well as those due to sudden atmospheric changes, and we have an instrument theoretically almost perfect.

Through the efforts of Laplace, Newton, and Pierce, the theory of nautical astronomy has reached a point of perfection that only awaits the determination of the true dimensions of the solar system, (which it is hoped the next transit of Venus will give) to make it all that can be desired. The invention of the chronometer has practically solved the problem of longitudes. And the needle of the mariner's compass has felt the touch of a Ritchie, and trembles no more; whilst Beecher and Davidson have given the navigator artificial horizons that

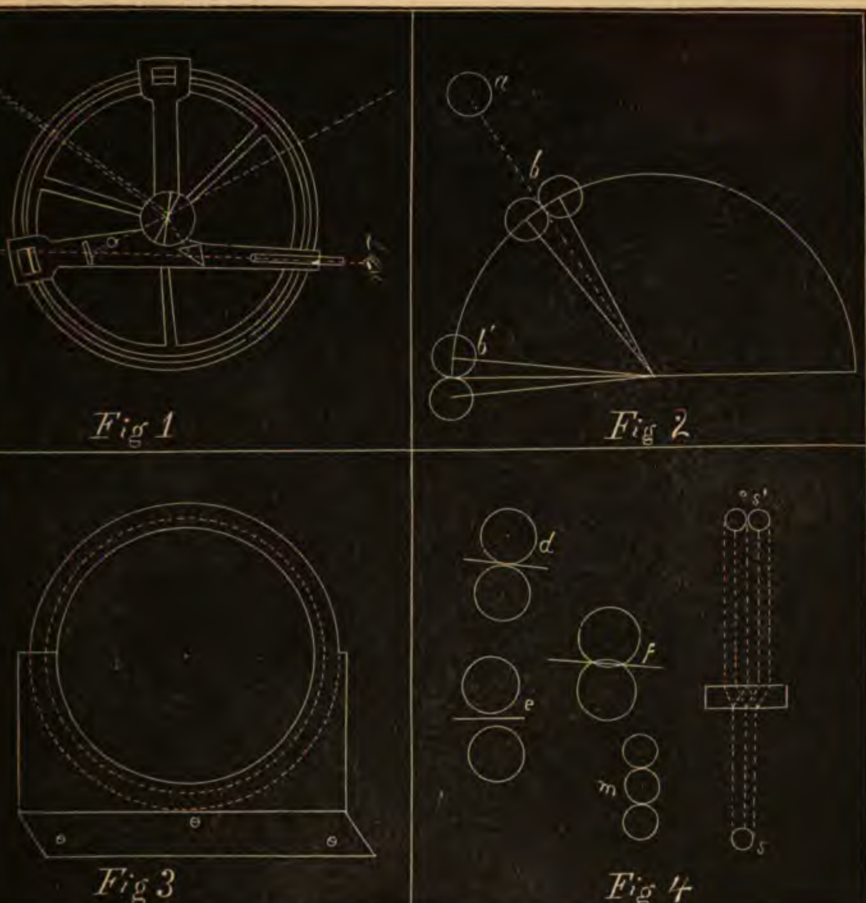

Fig 1 Fig 2 Fig 3 Fig 4

IMPROVED METHOD OF OBSERVING ALTITUDES OF THE SUN AT SEA, LOWRY.

(TO FACE PAGE 310.)

leave but little to be desired in that direction. But still improved methods of observation are wanted to decrease the frightful number of marine disasters. And though the ideas here advanced are believed to be a step in the right direction, yet they are also thrown out with a hope of eliciting from others a more complete solution of this problem, than which none other more interests mankind. And the complete solution of it—that would make practical navigation one of the exact arts—would evoke the lasting gratitude of civilized man the world over.

Regular Meeting, June 15th, 1874.

President in the Chair.

Forty-six members present.

A. E. Head was elected a life member, Charles T. Dake and James W. Winter resident members, and J. G. Lemmon and H. W. Howgate corresponding members.

Donations to the Museum: W. N. Lockington presented several cases of insects, and some alcoholic specimens. Mr. Dameron presented a lizard, from China, used for medicinal purposes; also, a fossil, from Forest Hill, Placer County. Major William Ford presented, through Messrs. Barry & Patten, a supposed weight for distension of thread, used in spinning, an aboriginal stone implement, found twenty feet beneath the surface, in cement gravel, at Martinez, Contra Costa County, California.

Mr. James Lick presented some fragments or pieces of the battle-flag which waved over Fort McHenry, during its bombardment, on the 13th and 14th of September, 1814. Accompanying this gift was a letter from Mr. Lick, and one to him from Commodore George Henry Preble. Also, a pamphlet, containing description of flag, entitled, "Three Historic Flags, and Three September Victories," a paper read before the New England Historic Gene-

alogical Society, July 9th, 1873, by George Henry Preble. The correspondence referred to is as follows:

COMMANDANT'S OFFICE, NAVY YARD,
PHILADELPHIA, June 6th, 1874.

JAMES LICK, ESQ.

Dear Sir: Seeing in the paper this morning an account of your having left several thousand dollars to the city of San Francisco for the purpose of erecting a monument to the author of the "Star Spangled Banner," I am prompted to send you a copy of my pamphlet, "Three Historic Flags," which will give you a history of the flag of Fort McHenry, and a heliotype of the flag. I also enclose a few fragments of the flag itself, which is now in my charge, at the rooms of the New England Historic Genealogical Society, to which my friend, Captain William C. Parker, U. S. N., not long since proposed you as a corresponding member. Excuse this intrusion from a stranger in admiration of your noble generosity, and I am,

Very truly, yours,

GEO. HENRY PREBLE,

Commodore U. S. N., Commandant Naval Station, Philadelphia, Penn.

PROF. GEO. DAVIDSON, PRESIDENT CALIFORNIA ACADEMY OF SCIENCES.

Dear Sir: Through the kindness of Commodore George Henry Preble, Commandant of the Naval Station at Philadelphia, I am favored with three small fragments or pieces of the battle-flag which waved over Fort McHenry, at Baltimore, during the bombardment, on the 13th and 14th of September, 1814; and, in presenting them to the Academy, I do so, regarding them as precious mementoes of a great event, and trust they will be carefully preserved and cherished by the Academy as among their most interesting relics.

That they will be so preserved I am assured, as well from the fact of their being portions of the original Star Spangled banner, which floated so triumphantly over Fort McHenry, "Amid the rocket's red glare and bombs bursting in air," and which inspired Francis Scott Key in writing our noble anthem, as for the thoughtful kindness of Commodore Preble in presenting them.

Yours respectfully,

JAMES LICK.

Donations to the Library: Professor Davidson presented "Comparison of the methods of determining heights by means of leveling, vertical angles, and barometrical measures, from observations at Bodega Head and Ross Mountain, by George Davidson and Charles A. Schott, Assistants U. S. Coast Survey." Professor Edward S. Morse presented "Remarks on the Relations of *Anomia*"; "On the Tarsus and Carpus of Birds"; "On the Systematic position of the *Brachiopoda*"; "Embryology of *Terrebratulina*"; "On the Early Stages of *Ascidian*"; "On the Early Stages of *Terebratulina septentrionalis*." From

Charles L. Weller, one hundred books, as follows : Pacific Railroad Reports (10 vols.) ; Perry's Japan Expedition (2 vols.) ; Naval Expedition to Chile (2 vols.) ; Military Commission to Europe, 1856 ; Congressional Globe and Appendix, (34 vols.) ; Life and Works of John Adams, (10 vols.) ; Byron's Works ; Rambles in Egypt and Candia ; Travels in Central America, by John L. Stephens (2 vols.) ; Journals of California Legislature, (5 vols.) ; Dictionaries—French, German, and Spanish ; Cyclopedia of History ; Benton's Thirty Years in United States Senate, (2 vols.) ; Campaigns of Lieutenant-General Forrest ; San Francisco Municipal Reports ; Fleetwood's Life of Christ ; Barnard's Commission to Isthmus of Tehuantepec ; United States Finance Report, 1868 ; Expedition down Colorado River ; Expedition to Great Salt Lake Valley ; California State Register, 1859 ; Sear's Pictorial Annual, 1849 ; General McClellan's Report and Campaigns ; Gil Blas ; Inskip's Methodism ; Notes on Duels and Dueling ; Life of Nicholas I. of Russia ; Administration of John Adams ; German Reader ; Latin Reader ; Spanish Grammar ; Sportsmen's Manual (Forrester) ; Mill on the Floss ; Guizot's Civilization in Europe ; Eulogies on Webster ; Travels in Western Mexico ; Exploration of the Amazon ; Mother's Recompense ; The Last Days of Lee ; Owen's Geological Survey of Iowa, Wisconsin, and Minnesota. The following periodicals were also received : Nature, Vol. X., Nos. 237 and 238, May, 1874 ; American Naturalist, June, 1874, Vol. VIII., No. 6 ; American Journal of Science and Arts, June, 1874, Vol. VII., No. 42 ; Engineering and Mining Journal, May 30, 1874, Vol. XVII., No. 22 ; Bulletin of the Essex Institute, March, 1874, Vol. VI., Nos. 4 and 6 ; Entomological Contributions, No. 3, by J. A. Lintner, from the 26th Annual Report of the New York State Museum of Natural History, for 1872 ; Cosmos Comunicryioni sui Progressi pici regenti e note voti, della Geografica e delle Scienze de Guido Cora, Vol. II., 1874 ; No 99 of Société Entomologique de Belgique.

S. C. Hastings read a paper in reference to the late alleged manifestations in Oakland.

Dr. Fourgeaud read a paper, a continuation of previous papers, "On Evolution."

The President called the attention of the members to some phenomena which he observed at the Naval Observatory, while looking at an artificial transit of Venus. At the time of the earlier observations of this planet, there was a doubt as to a phenomenon which showed an apparent adherence of the limb of Venus to the edge of the sun in the internal contact. This was known as the "black drop," when Venus showed an irregular spherical condition. As soon as I saw the artificial Venus, I recognized the cause of this thing. We see it every day in the work of the Coast Survey. It is simply the undulation of the atmosphere when it is surcharged

with aqueous vapor. At an elevation of seven thousand or ten thousand feet, where the atmosphere is attenuated, this is not apparent. In observations takén by me lately in the Sierras, the sun was sharply outlined, but this was at a high elevation. I have no hesitation in saying that former theories on this subject were incorrect, and that the undulation of the atmosphere when filled with aqueous vapor is the true cause. If the morning is dark and cloudy, the artificial Venus can be seen with a sharp contact; but, when the clouds broke away, and the aqueous vapor was heated up, the "black drops" could be seen. The transit of Venus must accordingly be observed at a high elevation, for there they will be enabled to determine within eight or ten seconds the actual time of contact.

The President also called the attention of the members to the admiration of James Lick's generosity which scientific men in the East hold. These actual deeds were not known when I left Washington, but some of the facts were made known in his will and had been spoken of. Some of his donations he has changed, but he has given for the observatory a sum adequate for erecting the largest observatory in the world with the finest instruments. There will be plenty of money left to provide observers and assistants, and for publishing the results of the work accomplished. In some observatories they have to solicit funds to publish the results of their work. Mr. Lick did not want any such drawback in this instance. He has given enough to carry it on properly in every respect. His gifts have excited unbounded admiration among the physicists and astronomers in the East.

The President also stated that Mr. Mumford, of the Telegraph Company, had shown him an instrument for the transmission of musical sounds along a telegraph wire. He himself heard distinct musical sounds sent 800 miles. He has asked Mr. Mumford to extend a wire to the Academy's building, so as to show the members this remarkable invention. A detailed description of the instrument could not be given until patents were obtained.

Professor Edward S. Morse was introduced by the President, and congratulated the members on the prosperity of the Academy, comparing it with respect to means to similar societies in the East-

ern States. Professor Morse, in speaking of the earlier efforts of our Academy, said: "In the East we are familiar with your publications; I wish to tell you that when the first 'proceedings' came along, we were somewhat amazed, and thought that some young men were starting it, and the Society would only last a year or so. From year to year you kept on, and we saw that the papers you published showed reasonable research. We saw that you did not decay and were getting on; but we never dreamed that you would get an amount of money more than that all of our Eastern Societies put together."

He then spoke of the different scientific societies in the Eastern States and their pecuniary resources, enumerating the sums of money given to the prominent ones, and said: "Add all these sums together, and the sum given to the Academy of Sciences by Mr. Lick exceeds all the endowments of the natural history societies in the Eastern States. The California Academy now starts with a sum equal to all. Mr. Lick has gone ahead of Peabody, as far as science is concerned, for Mr. Peabody endowed educational institutions liberally, but gave only about $300,000 to purely scientific societies. The position occupied on the globe by the California Academy is a fine one, as it is the only endowed society on the Pacific Ocean. It has plenty of money and a large area for investigation."

Professor Morse in the course of his remarks said: "Science has changed a great deal in the last ten years. Our old proceedings of societies were merely technical; now they are broader. As your President said in his last report, 'There is no money in this country for individual pursuits.' In Europe this is done, but not here. There large sums are appropriated to assist Professor Blank in his investigations. In this country our naturalists are poor. So in a society they must label specimens, and do miscellaneous work, and get no time for investigation. The primary object of your Society is to furnish original investigators. Now you have ample funds to employ specialists, and you must impress upon them that they must give the results of their investigations to you. Do not let them be too practical. Do not let the bread-and-butter idea preponderate. There are other things for men to do beside to eat and drink and make money."

The President announced the death of M. Adolphe J. L. Quetelet, an honorary member of the Academy, and also the death of Leander Ransom, a resident member. In speaking of the latter, he said: "Col. Leander Ransom's name appears on the records at the second meeting after the organization of the Academy of Sciences, April 11th, 1853, and from that time onward he took an active part in the work of the Academy. On January 5th, 1854, he was elected Second Vice President; on January 7th, 1856, elected President, and continued to preside as first officer until January, 1867—eleven years.

"His scientific papers were few, yet his labors in the cause of science and his warm sympathy and support of those more actively engaged in natural history studies, call forth our admiration, more especially when we consider that in those early days of gold-seeking and local excitements of one kind and another, came the cares of settling a family in an unbuilt city; and when we find him regularly and punctually attending the weekly meetings of the Academy for so many years, we can but poorly award him the meed of praise. We might go on in words to extol his geniality, gentleness, and liberality, yet we leave the records of the Academy, the objects he presented to the museum, and books he contributed to the library, to be a constant memorial of his worth to our institution."

Regular Meeting, July 6th, 1874.

President in the Chair.

Forty-five members present.

The following resident members were elected: William B. May and C. H. Wakelee.

Donations to the Museum: Ore from the Little Giant mine, San Juan, Colorado. The dark line in the specimens is said to yield $20,000 per ton. Also, specimens of argentiferous galena, and of silver associated with heavy spar. T. J. Butler, of Redding, pre

sented a specimen of *kaolin* (?) from the banks of Pitt River, Shasta County; a piece of lava from Siskiyou County. Also, specimens of copper, coal, and iron, from Shasta County. W. G. W. Harford presented a pair of slippers such as are used by fishermen on the Japanese island of Strick. Henry Edwards presented twenty-six specimens of crustacea, two of them from Canton, China; three chrysalis cases (*Oiketicus*) from Mazatlan; one specimen of *Echinoderms*, Vancouver Island, three from Mazatlan, and one from Panama; seven specimens (six species) *Ophiernidae* (?) Mazatlan; *Gorgonia* and corallines from Mazatlan; two nests of tarantula with the spiders from Calaveras County; Ten species of *Cirrhipedes* from various localities. Dr. Kellogg presented specimen of *Amorpha*.

The President donated a series of photographs (25) of the hieroglyphic inscriptions on the blocks found on Easter Island. A letter was read on the subject of these hieroglyphics from Mr. Crofts as follows:

PAPEETE, Tahiti, April 30th, 1874.

DEAR SIR: Your very complimentary letter, of February 4th, was received by me at a moment when I was prostrated by a severe illness; but I availed myself of the first hours of convalescence, *con amore*, to attend to your very natural, and indeed, somewhat anticipated requests. Being informed by Monseigneur Axieri that it would be impossible for him to let you have one of the blocks, I have spared no exertions to obtain for you two good sets of photographs of all of them, in accordance with your desire.

The Bishop, owing in part to his desire to ameliorate your disappointment in not being able to see and handle one of the coveted articles, and partly owing to his own innate good nature, has done all he could to assist me, lending me the blocks (some of them twice over) to be taken to the photographer, and also loaning me the manuscript chart of Easter Island, and a lithographic view of some of the statues, (or rather "busts") together with other assistance.

Mr. De Greno, a Swede, now residing in Papeete, who was passenger in a ship which was sunk at Easter Island, having been run in there in a sinking condition, and who was obliged to stay there some months until taken off by a brig calling there on her way here from Valparaiso, and who takes an interest in everything referring to that island, has kindly lent me part of a *Harper's Weekly* of April 26th, 1873, from which I have had photographed a portion of an engraving of a scene in Easter Island. I should advise you to obtain a copy of the said *Weekly*, and see the whole picture, and read the account accompanying it. I have submitted it to the examination of a number of Easter Island natives, and they inform me that it is a very true representation of the actual

state of things, both with reference to the "statues," and to the dress, dances, and appearance of their people at home. Mr. De Greno also substantiates their statement.

I have numbered and otherwise classified the "photos," (ordering the photographer to preserve the margins for that purpose) so that I think you will be enabled, from the directions written by me on them and in the letter accompanying them, to arrange them properly. One of the blocks is more than a yard long, and I was obliged to have the "photo" taken in six sections—three on each side—in order to have the characters sufficiently large and distinct to enable you to read them.

The blocks are of different sizes and shapes. I will explain why they are so. Many long ages ago, (according to the account the natives of Easter Island, now living in Tahiti, give me) the population of that island had grown to be very great, numbering some thousands; and as the island is small, being only about twenty miles long, they found it was necessary, on account of having to depend entirely on their own resources, to cultivate every spot of land that was capable of cultivation. For this reason they destroyed all the trees, and planted sweet potatoes, yams, etc., where those trees had grown. From that time to this, they have never had a tree more than say two inches in thickness, and that of a soft, quick-growing kind, which they were obliged to use before its wood had time to harden. Owing to this circumstance, after they had consumed all the wood from their ancient forests, they were obliged to pick up the drift-wood cast on their shores by the ocean, and collect, from whatever other source they could, any kind of hard wood they could procure in order to record whatever they wished to record. This accounts for the varieties of wood, the singular shapes, and the variable thickness of the blocks.

These records or blocks, they say, were extremely numerous in former times; but a great many were destroyed during their frequent wars, when each party would, in their anger, injure the valuables of the opposing party. Some of the natives, however, have told me, with what truth I know not, (for the natives of all these islands cannot be depended upon for the truth) that soon after the Catholic missions were established on their island, the missionaries persuaded many of their people to consume by fire all the blocks in their possession, stating to them that they were but heathen records, and that the possession of them would have a tendency to attach them to their heathenism, and prevent their thorough conversion to the new religion, and the consequent saving of their souls. Others of the natives deny this statement altogether, and are very strenuous in saying that it is false. I may here mention that the latter are Catholics, and are living with the Bishop. Their statements should be taken with some allowance. Those who make the charge, on the other hand, are employed by Mr. Brander, a merchant and planter here, and are not subject to the control of the Catholics.

Mr. De Greno, the Swede before spoken of, tells me that when he first landed on the island, the natives showed him and his friends quite a number of the records, and they seemed to attach a great value to them; for some three or four months after, when he was about leaving, and desired to take one or more of

them away with him, he found it impossible to get one by any means, and, indeed, many of the natives denied having any. The captain of the sunken ship, however, managed to get two or three of them, which he has taken to Europe.

Mr. Calligan, mate of an American vessel from your port, which vessel was lately wrecked on Easter Island, where he and his friends built a boat from the remains of the wreck, and came down in it to Tahiti, (and who now commands a small schooner sailing among the islands here) also managed to get one of the blocks, which, he has told me, (he is absent just at the present writing) he has sent to his wife, somewhere in California, I think. When he returns, I will try to find out where, and inform you, so that you may have an opportunity to see and probably obtain it, or at least to obtain a photographic representation of its characters.

Mr. Parker, a merchant of this place, informs me that some three or four years ago, when nearly three hundred of the Easter Island natives were brought to Tahiti, (as laborers for a term of years, which are now expiring) they had a number of blocks in their possession which they tried to sell; but they charged such a high price for them that no one bought them. He says that *they* seemed to think that they were very valuable, but they could not bring any one else to their way of thinking. Mr. Parker says that he thought (not understanding their language) that they were mere bits of wood on which they had tried their skill at carving, and that the characters were merely ornamental, and that he did not sufficiently admire such ornaments to cause him to invest any money in it—at any rate, as much as they demanded. Had he known that they were portions of their records, inscribed in an ancient and peculiar language, he would have bought all he could get at any price. Although I was present here, myself, in Papeete, at the time, these blocks entirely escaped my notice, nor did any one give me the slightest hint of their presence. Had I had Mr. Parker's opportunity, it is quite probable that I should have laid this matter before the scientific world years ago. It is barely possible that there may be some of these blocks now in the possession of some one in Tahiti—Easter Island natives or others; and I am making inquiries for the purpose of obtaining, if possible, one or more of them for you.

In reference to my translation of the inscriptions, I am sorry to inform you that I was cruelly disappointed in my interpreter. On the day on which he was brought to my residence by his countryman, who had recommended him as competent to give me a translation of the characters, I wrote down part of what he pretended to interpret for me, and my hopes were raised to the highest pitch. This day was Sunday, the only day when he was at leisure to attend to such things. During the following week I had mislaid the manuscripts, and when he came again on the succeeding Sunday, I thought it best to begin anew with the translation, and I proceeded to again write down his interpretation, both in his own dialect and in the Tahitian dialect of the Malay language. As I proceeded, however, it struck me that the second translation of the same characters differed materially from the first. This thought kept growing upon me more and more as I advanced, until at last I became convinced that he was de-

ceiving me, and that he did not or could not truly interpret the characters. I concluded, however, not to be too hasty in the matter; and so I gently told him to go away for the present, and to come back again on the following Sunday. He did not come again on that day, and not until the next Sunday. In the meantime, however, I had found the first manuscript, and having compared it with the second, I found that they differed very greatly. When he finally came again, I requested him to again go over his former translation, so that I might correct the errors and omissions in my manuscript. He did so, and I found that his third pretended interpretation again differed from either of his former translations. I then called his attention to these facts—told him that it was impossible that the same characters should have three different meanings on three different Sundays; that he knew nothing, probably, of the meaning of the characters; that he was trying to deceive me, and that he had better leave. He left.

The Bishop has also been trying his hand in translating the inscriptions. He showed me a manuscript book of considerable thickness, which he thought contained an interpretation of most of the characters on the "photos" marked Nos. 5 and 6 on our list, being the two sides of one of the blocks. In this work he says he was assisted by one of his own people, (a native of Easter Island now in the employ of the Mission) who acted as interpreter. I advised him to subject him to a similar test to that to which I had subjected mine, when I fear he will be undeceived as I was. He promised to do so when opportunity occurred.

Mr. De Greno informs me that when he was on Easter Island he saw two very old, decrepit natives, whom he was told were taught, in their early youth, to read and inscribe the records, and thought that it was quite probable that they could do so.

In regard to the great stature which you say in your letter is mentioned by Roggewein, I have noticed that their stature was rather small than great—seldom exceeding six feet, and rarely attaining that. I made inquiries of them as to the probable cause of this difference between the stature of their ancestors and their present height. They stated, in answer, that some twelve years ago their island was visited by a number of Peruvian vessels, as many as nine at one time. These vessels sent a part of their crews on shore, armed, and then the vessels surrounded their island, firing on them with cannon, while the boats' crews, combined, were driving and firing upon them with muskets. In this manner a number of them were killed, for they had no firearms, and were too timid to make close work of it. The consequence was, they were obliged to surrender, and after being all collected in one place, their pitiless conquerors proceeded to select all the largest and most powerful men, and after securely putting them in irons, took them on board the vessels and carried them off into slavery, to carry heavy sacks of guano on the Chincha Islands. They have some boys, however, growing up, and who promise to make large men. I have had one of them photographed for you (No. 17) by himself, and again in the groups, (Nos. 10 and 11) where he is the central figure, being already taller than the full-grown men beside him.

You ask, also, for photographs of the scenery of Easter Island. I have no means by which I could obtain a photographic view of that kind. But after somewhat lengthy conversations with the natives, Mr. De Greno, and others on that subject, I think I can give you a pen-picture of some of the scenery. Fancy an island which raises smoothly from the principal portion of the shore to hills of moderate height, divested for the most part of rocks and roughnesses. In three parts of the island are extinct volcanoes, as laid down in the chart. Their craters, however, have been rounded down by time and the "elements," and the whole appearance of the island indicates great age, much older than Tahiti and its surrounding islands. There is not a tree or bush to be seen on the island, except some few that have been planted near the residence of Mr. Dutron-Bornier, a French sea-captain now residing on the island, and who is connected with Mr. John Brander, of this place, in sheep and cattle-raising there.

In reference to your question, "How do the natives of Easter Island obtain fire?" I have to answer that they cannot tell. Their forefathers, like the ancient Romans, had their "vestal" fires, preserved from ancient times; but the "*Vestal Virgins*" of Easter Island were gray-headed and gray-bearded old heathen priests. It was a part of their duty, sacredly attended to, to guard the eternal fire, which was neutral, together with its guardians, in all wars. From this sacred fire the whole community—at one time a large one—could obtain that useful "element" from time to time, as they needed it, for culinary and other purposes. This custom is still kept up by a portion of the community, while another portion rely on the matches of Mr. Dutron-Bornier for their supply. Another portion of the community have learned from Gambier Islanders (who were sent there by the Catholics, to assist the priests) how to make fire: not by rubbing two sticks together, as you ask in your letter, but by rubbing the point of one stick on the side of the other, until it makes a hot groove and eventually fire—a work generally of from five to ten minutes. In order to illustrate this, I have had a photograph taken for you, showing you the natives in the very act of producing fire, and have also sent you the identical sticks used on that occasion. You will notice that the wood is of a soft and spongy nature. It grows abundantly on these islands, and is a variety known as the *Hibiscus tiliacus*, and called by the natives "*Purau*" and "*Fau*," pronounced "*Purow*" and "*Fow*," "*ow*" being sounded as in the word "*how*." You can, if you wish, obtain large quantities of it, by going on board the vessels carrying oranges from these islands to San Francisco; the orange crates are mostly made of it. And you could also get one of the Tahitian or other islanders, sailors on board of such vessels, to make fire for you by the aid of these sticks, and thus practically or ocularly answer your own question, as they are all experienced in the art.

As to the cord of human hair, it is no doubt of very modern origin, and therefore of no value in investigating the age of the inscriptions or the origin of the language. I have, therefore, not sent you any of it. The natives of the islands are all the time making it, and it is of no value in reference to matters of antiquity.

I spoke to the natives about the *white* men seen by Roggewein. They state

that some of their people are very light-colored when they are not much exposed to the sun's rays. And it may have been much more so formerly, and the lighter portion may have been readily mistaken for white men; for they were quite as light as some white sailors who are much exposed to the sun.

Mr. Calligan, before spoken of in this letter, informs me that during his forced stay on Easter Island he kept a journal, noting down things which came under his observation, and that he has sent it to his friend, Mr. MacCrellish, of the San Francisco *Alta California*, who will doubtless publish extracts from it. You will thereby, perhaps, be able to learn much about the island, written upon the spot, with all the freshness of narrative that usually accompanies articles so written.

Mr. Viaud's work, though in French, will also be interesting, being, like Mr. Calligan's, so very modern, and written upon the spot. You will find it noticed in *Harper's Weekly* of April 26th, 1873, before mentioned in this letter.

I am very anxious to see whether the characters on the blocks agree with those on the sculptures on the island of Java and other East Indian islands on the coast. If you have now, or can get a chance to see, a work on East Indian sculptures, please consult it and inform me of the result.

Yours in haste,

THOMAS CROFT.

PROFESSOR GEORGE DAVIDSON,

President California Academy of Sciences, San Francisco.

PAPEETE, Tahiti, April 30th, 1874.

PRESIDENT CALIFORNIA ACADEMY OF SCIENCES.

Dear Sir: Yours of the 4th ult., requesting me to procure for you photographs of all the blocks of characters in the possession of the Mission here, and also the scenery, monuments, people, etc., of Easter Island, was duly received by me, and I hasten to comply with your requests. Accompanying this letter you will receive 52 photographs in duplicate, as follows: Nos. 1 and 2 back each other; Nos. 3 A, 3 B, and 3 C, and Nos. 4 A, 4 B, and 4 C, also back each other; the block from which they were taken is over a yard long, and I was obliged to have it taken in six sections, three on each side, in order that the characters should be large enough to enable you to see them distinctly. Nos. 5 and 6 back each other—that is, the one was taken from one side of the block, and the other from the other. No. 7 is taken from a lithograph in possession of the Bishop. No. 8 is taken from a manuscript chart of Easter Island, also in the possession of the Bishop. This chart was made by the officers of the Chilian corvette *O'Higgin* in 1870, as stated on the chart; the names having been corrected by the Bishop personally, from information derived from the islanders themselves now in his employ here. No. 9 was taken from part of an engraving contained in *Harper's Weekly* of April 26th, 1873, which please see, as it is interesting and truthful; it and the lithograph were taken by Lieutenant Viaud, of the French frigate *La Flore*, Admiral de Lapelin, on the occasion of said Admiral's conveying away one of the busts from Easter

Island, and which he brought here, afterwards took to France. I called him Admiral Roussén, in mistake, in my first letter to the California Academy of Sciences. No. 10 and No. 11 are two groups of natives of Easter Island, differently taken, on account of the imperfection of the camera used, which was a French instrument. The photographer is about to receive an American camera from California, when he hopes to take the large photographs in a better manner. Nos. 12 are two different photographs of the natives in the act of making fire, taken just at the moment of producing fire. One of them holds his hat to prevent the wind from cooling the groove and blowing away the fine wood dust which is produced by the rubbing, and which forms the tinder; another holds the stick rubbed, to prevent its being disarranged, and the third has just finished the rubbing. Nos. 13 and 14 back each other, and are similar to those in the archives of the Academy. Nos. 15, 16, 17, 18, 19, and 20, are portraits of Easter Island natives as they now dress, in the employ of the mission here. Nos. 21 and 22 back each other. No. 23 is a photograph taken at the request of the Bishop, some time since. I have procured two copies to send to you, because it is interesting. The gray-bearded priest in the center is one of two priests who were formerly on Easter Island, and who are accused by a portion of the islanders of causing that act of vandalism, the destruction of a great many of the records. On each side of him stand the two husbands of the two women, and the fathers of the two small children, whose mothers hold them in their arms. I have had the portraits of the two women taken larger, (Nos. 19 and 20) so that you can better see their features, and also the husband of one of them, (No. 19) who is No. 16, in order that you may see his features. The other one refused to be taken. In No. 23 you also may see, in the hands of another priest, one of the blocks from which I have had two of the photographs taken. You may also see in the hands and on the persons of different natives, some of the idols, paddles, and implements used by the heathen priests in their worship.

Both the Bishop and myself would be extremely pleased if you would send us a copy of the Proceedings of the California Academy of Sciences, containing my letters on this affair, to be preserved as a souvenir of passing events, and as containing in a printed form the information which I and others have collected.

Mr. C. B. Hoare, the photographer here, wishes me to state that he will preserve the negatives from which all these photographs have been taken, and if you or any of your friends wish any more, he will be able to furnish them at a much lower price than he is obliged to charge for these.

I have presented to the Bishop, in your name, a copy of each of the photographs, as some compensation to him for his kindness and trouble. I feel certain that I shall receive your approbation for so doing.

I have retained a copy of each of the photographs, numbered and marked precisely like yours, so that if you need any more explanations, or wish to order any one or more of them, you need but state its number, when I will look at mine, and understand you perfectly.

My charge for my services is nothing. The photographer's bill amounts to seventy-five dollars, ($75) he tells me, which you will please pay to A. Crawford & Co., as you suggested. Yours, etc.,

THOMAS CROFT.

Mr. F. Gruber presented the following specimens of birds stuffed: Swallow Fruit-eater, (*Procnias ventralis*) male and female. Long-billed Marsh Wren, (*Cistothorus palustris*). Song Thrush of Europe (*Turdus musicans*). House Sparrow of Europe (*Passer domesticus*). European Jay, (*Corvus glandarius*). Green Paroquet, (*Psitacula passerina*) from South America. Crimson Tanager, (*Ramphocilis brasilica*). Black cap Titmouse, (*Parus ater*). Four species of Brazilian humming birds; Bay-breasted Warbler from Pennsylvania; Black-banded Tanager from Central America; Toucan, from the Islands of New Guinea; Australian Bee-eater; Black-banded Troupiale; Oregon Thrush. Several other specimens of bird skins were also presented by Mr. Gruber.

Donations to the Library: Astronomical Register, No. 138. Annals and Magazine of Natural History, Vol. XIII, No. 78. Monatsbericht der Königlicht Preussischen Akademie der Wissenschaften zu Berlin, Marz. 1874. Annals der Physik und Chemie, No. 3, 1874. Proceedings of the American Academy of Arts and Sciences, Vol. IX. Instructions for observing the Transit of Venus, Dec. 8 and 9, 1874, (from the Naval Observatory). The Journal of Botany, No. 138, London. Nature, No. 239, Vol. X, May, 1874. Verhandlungen der Gesellschaft Erdkunde zu Berlin, No. 4, 1874. Entomological Contribution, No, 3, by J. A. Lintner, 1872. Cal. Horticulturist, No. 6. Report of Board of Officers on the Gatling Gun, Washington, D. C., 1874. Observations on the genus Unio, Vol. XIII, Philadelphia, presented by Dr. Isaac Lea. Geographical and Geological Surveys west of the Mississippi, Washington, May, 1874. Engineering and Mining Journal, May and June, 1874. Catalogue of Birds ascertained to occur in Illinois, by Robert Ridgway, 1874. Birds of Colorado, by Robt. Ridgway. Mittheilungen der Deutschen Gesellschaft für Natur und Völkerkundi ostasiens Herausgegeben von den Vorstandt Yokohama, Jan., 1874. Overland Monthly, Vol. XIII, No. 1. Proceedings of the Academy of Natural Sciences of Philadelphia. Geological Survey of Hok Kaido. Popular Science Monthly, No. 27. Descriptions of New North American Phalænidae and Phyllopoda, by A. S. Packard, Jr. "On the Transformations of the common House Fly, with notes on allied forms," by A. S. Packard, Jr. Seventh Annual Report of the Provost to the Trustees of the Peabody Institute, Baltimore, 1874. Prof. Davidson presented "Field Catalogue of 983 stars," by Geo. Davidson. Also, Report of B. A. Gould, of the Argentine National Observatory, Cordova, Jan. 31st.

The President communicated the results of some observations on the comet, with respect to its exact position, stating that he had made observations for its position on the 28th of June and 2d of July. The approximate position on the latter date was, Right Ascension, 7 h. 38½ m. and 63° 59′ north declination.

Pacific Coast Lepidoptera, No. 5—On the Earlier Stages of some Species of Diurnal Lepidoptera.

BY HENRY EDWARDS.

Since the publication of my last paper on this most interesting branch of entomological research, I have been fortunate enough to make myself acquainted with the earlier stages of some of our butterflies, previously unknown to me, and have, in addition, received from friends some MS. notes on other species; while from various publications I have gleaned a few particulars concerning others The whole of this information I have endeavored to place in a concise form before the student, and I believe that the present and previous articles will be found to contain all the knowledge we possess concerning the earlier stages of our diurnal Lepidoptera. It will readily be seen how small is its amount, and how grand a field for observation is still open to those who desire to pursue so interesting an inquiry. To those living in the country a more agreeable and fascinating amusement cannot well be conceived, than the watching and rearing the larvæ of insects; and a very little practice in the matter will serve to increase its charm, while it will make the task more easy, and, at the same time, render almost incalculable benefit to those scientific observers who, living in cities, have not the time and opportunity at their command to devote to this branch of study.

As previously stated, I shall be happy to afford any information in my power, and will at all times gladly award to any who may assist me, all the credit due to their discoveries.

Papilio Daunus.

Chrysalis. General shape the same as *Rutulus* and *Eurymedon*, but a little shorter and stouter proportionately, and considerably darker in color, which is dark greenish-drab, with the dorsal region broadly and distinctly shaded with black. The mesonotal process is very rough, and the antennal cases decidedly black. The wing cases are streaked with blackish-brown. The head is marked with a broad, fawn-colored patch, and a streak of the same color is along each side of the abdomen, indicating the pale yellow stripes on each side of the body of the imago.

Length, 1.60 inch.

I regret to be able to add little with reference to the larval state of this beautiful insect. I am informed by Mr. W. T. Eaves, of Virginia City, (to whom I am indebted for a number of specimens of the chrysalis) that the caterpillar is dull green, with some yellowish stripes, and that it feeds upon a species of wild

cherry, common in Nevada. Those found by Mr. Eaves changed to chrysalis late in April, and from ten specimens presented to me, I was fortunate enough to raise six males and four females, all in perfect condition. They emerged from the 27th of May to the 8th of June.

Pieris protodice.

Larva. "Average length when full grown, 1.15 in. Cylindrical, with the middle segments largest. Most common ground color, green, verging on blue, sometimes clear pale blue, and at others, deep indigo or purplish blue. Each segment has six transverse wrinkles, (of which the first and fourth are somewhat wider than the others) four longitudinal yellow lines equidistant from each other, and each interrupted by a pale blue spot on the before mentioned first and fourth transverse wrinkles. There are traces of two additional longitudinal lines below, one on each side, immediately above the prolegs. On each transverse wrinkle is a row of various sized, round, black, polished, slightly raised piliferous spots, those on wrinkles one and four being largest and most regularly situated. The hairs arising from these spots are stiff and black. Venter rather lighter than ground color above, and minutely speckled more or less with dull black. Head same color as the body, covered with black piliferous spots, and usually with a yellow or orange patch on each side, quite variable. The black piliferous spots frequently have a pale blue annulation around the base, especially in the darker specimens. When newly hatched, the larvæ are of an uniform orange color with a black head, but become dull brown before the first moult, though the longitudinal stripes and black spots are only visible after that moult has taken place.

"*Chrysalis.* Average length, 0.65 inch.

" It is as variable in depth of ground color as the larva. The general color is light bluish-gray, more or less intensely speckled with black, with the edges and prominence marked with buff or flesh color, and having large, black dots." C. S. Minot in *Am. Entomologist*, vol. II, p. 77.

The caterpillar of this common species feeds on various cruciferous plants, and may be sought for in the San Joaquin and other valleys, where the butterfly occurs in great abundance, though it is somewhat periodical in its appearance. It is probable that it will one day become a serious pest to our market gardener, as cabbages and other allied plants suffer largely from its attacks.

Anthocaris ausoniedes. Bdv.

" *Larva.* Head round, green, speckled with black. Body long, slender, dotted with black granules, and marked with three lead-colored stripes. Between these are two yellow stripes of similar width. The lateral lead-colored ones are, edged below with white shading into yellow. Under side, bluish-green. Feeds on cruciferæ, the larva attaining its growth early in July, and changing to a curiously-horned chrysalis, which tapers gradually and almost equally towards each extremity. At first glance, it much resembles a brown and curled-up leaf. The perfect insect escapes the following season."—T. L. Mead.

I am indebted for the above description to my friend Mr. Mead, of Cornell University, who discovered the larva of this somewhat rare species in his tour through Colorado, and who was successful in raising it to maturity.

Colias coesonia. Godt.

This species has been found near San Diego by Mr. James Behrens, and must, therefore, be included among our California butterflies. The following brief description is the only one at my command:

"*Larva.* Green, with a lateral white band, punctured with yellow; besides this band, there is on each segment a transverse black band, bordered with yellow. Feeds on different species of *Trifolium.*"—Boisduval.

Terias lisa.

This and the following species have also been taken near the Mexican border. The descriptions of the larvæ, by Boisduval, are very vague and unsatisfactory, but I append them, having at present no better to offer:

"*Larva.* Green, with four longitudinal white rays. Feeds on *Cassia* and *Glycina.*

"*Chrysalis.* Green."—Boisduval.

Terias delia. Cramer.

"*Larva.* Green, with a longitudinal white line on each side, above the feet. Feeds on *Cassia, Glycina,* and *Trifolium.*

"*Chrysalis.* Green."—Boisduval.

Danais Berenice. Cramer.

"*Larva.* Whitish violet, with transverse stripes of a deeper color, a transverse band of reddish brown on each ring, divided in its length by a narrow yellow band. Along the feet, a longitudinal band of citron yellow. Long, fleshy processes of brown purple are disposed in pairs on the second, fifth, and eleventh rings. Feeds on *Nerium, Asclepias,* etc.

"*Chrysalis.* Green, with golden points on the anterior side, and a semi-circle of the same color on the dorsal side, a little beyond the middle, separated from a blue band by a row of three black dots."—Boisduval.

Found, but rarely, in the vicinity of San Diego.

Agraulis vanillæ. Bois.

"*Larva.* Cylindric, pale, fulvous, with four blackish longitudinal bands, of which the two dorsal are sometimes obsolete; furnished with ranges of blackish ramose spines, of which two are placed on the summit of the head. Head with a whitish ray on each side, lined with black; feet, black. Feeds on *Passifloræ,* etc.

"*Chrysalis.* Russety brown, with some paler shades."—Boisduval.

Abundant in Lower California, and occasionally straying beyond the border. It has been taken on several occasions in the foothills near San Diego.

Argynnis myrinæ. Cram.

This species, which occurs somewhat abundantly in Alaska and British Columbia, has been reared from the egg by Mr. Sanders, who thus describes its various stages:

"*Egg.* Pale green, elongated, shaped something like an acorn, with the base smooth, convex, and the circumference striated longitudinally, with about fourteen raised striæ, which are linear and smooth; the spaces between are about three times wider than the striæ, depressed, concave in the middle, and ribbed by a number of cross-lines, fifteen to twenty between each striæ, and distinctly indented. The egg is contracted at the apex, the striæ protruding at the tip a little beyond the body of the egg. The eggs were deposited June 24th, and hatched in six or seven days. When fresh from the egg, the larvæ were about one-tenth of an inch long.

"*Larva* (young). Head medium-sized, black, and shining; the body above is dark brown, with transverse lines of a paler color, especially on the anterior segments; it is thickly covered with short hairs of a pale brownish color. Between the first and second moult it is one-fourth of an inch long. The head is bilobed, shining, black, and hairy, and the body above is greenish black, the greenish tinge most apparent on the second and third segments, with a few small yellowish dots along each side, and transverse rows of strongly elevated, black tubercles, emitting numerous short, black, hair-like spines. The under surface is similar to the upper; the feet are black and shining, and the prolegs are black, tipped with a paler hue. After the second moult, there are two fleshy tubercles on the second segment much longer than the others, which are covered throughout with small, hair-like spines. The yellowish spots along the sides of the body assume more of an orange tint, and there are one or two faint longitudinal streaks of the same color along the sides close to the under surface, and between the rows of large raised tubercles are many smaller ones, which are also black, and appear but slightly raised.

"*Larva* (full-grown). Head, slightly bilobed, black, shining, and covered with short, fine, black hairs. The body above is dark grayish-brown, beautifully spotted and dotted with deep, velvety black; the second segment has two long, fleshy horns, yellowish white at the base, black above, covered with minute, blackish, hair-like spines. The third and fourth segments have each four whitish spines, tipped with black, those on the sides placed on the anterior portion of the segment, those above, about the middle. All the other segments have six whitish spines, except the terminal one, which has four. All the spines have five branches, of a black or brownish-black color, and one about one-third the length of the fleshy horns on the second segment. A pale line extends along each side, from the fifth to the terminal segments, close to the under surface. The under side is brownish-black, darker on the anterior segments; feet black

and shining; prolegs brown, with a shining band of brownish-black on the outside."—W. SANDERS, in *Packard's Guide*, p. 254.

"*Chrysalis.* This has two large, conical tubercles in front of the insertion of the antennæ, and two acute tubercles on the thorax. The thorax is acutely bituberculated on the sides, with an acute thin dorsal ridge, on each side of which are two small, sharp tubercles. Along the back of the abdomen are two rows of tubercles, those on the third abdominal ring being much larger. It is half an inch long, pale ash, with black dots and irregular lines."—PACKARD, *loc. cit.*

Pyrameis Caryæ. Hubn.

Larva. On exclusion from egg, almost wholly black, with faint yellow irrorations. After the first moult, the head is black, shining, densely and rather coarsely punctured. Body black, transversely mottled with lemon yellow, with a black dorsal line, and lateral waved lines of yellow, enclosing the stigmata. Spines black, ramose, those of the dorsal region yellow at their base. With each succeeding moult, the black gradually disappears, and the yellow markings acquire a paler shade.

Mature Larva. Head, brownish-black, thickly covered with whitish hairs. Ground color of the body, pale greenish-yellow, mottled irregularly with black and olive patches, and with a broken, black, dorsal line. The spines of the first four segments are black, with white branches, the whole of the remaining spines being dull fawn-color, darkest at their bases, with concolorous branching hairs. The stigmata are yellowish-white, surrounded by a black ring, and enclosed in a waved, mottled, black and olive band, from which proceed some narrow, oblique branches, joining the base of the lateral series of spines. Under side olivaceous, dotted with yellow. Feet and prolegs pitchy, with chestnut hairs.

Length, 1.25 inch.

Food plants, various species of *Malvaceæ.*

Chrysalis. Rather short, fawn color, covered over the whole surface with black dashes and dots, darkest about the thorax. The head is truncate in front, with two small, angular protuberances beyond the eyes. Mesonotal process rather short, angular, directed backwards. There are also two rather acute angular processes at the sides of the thorax. Abdomen, with three raised points on each segment, palest at their apex. At the junction of the thorax with the abdomen, are two small, subcordate patches of pure white, resting on two other small white spots at the base of the abdomen. Wing cases fawn color, with a few black streaks, and a submarginal row of six minute white dots, edged with black. Antennæ plainly visible, with the articulations distinctly marked. There are no gold or silver marks whatever.

Length, 0.85 inch.

Changed to chrysalis, July 2d. Imago, July 24th.

Limenitis misippus. Fabr.

"*Larva.* Cylindrical. General color, whitish. Head, dull olive, with dense minute prickles, its vertex bifid and terminating in a pair of prickly cylindrical horns,

transversely arranged, and each about 0.03 inch long. Back, speckled and mottled with olive of different shades above the line of the spiracles, except joints 2 and 8, and upper part of 7 and 9, but with a continuous pure white line above the spiracles, beneath which white line, on the fourth to tenth joints, is a large olive patch, extending on joints 6–9 to the external tip of the prolegs. A pair of black, transversely arranged dorsal dots in the suture behind joint 2, and a less obvious lateral one above the second and fourth pair of prolegs, surmounting the lateral white line. Joints 3–7 and 9–11 with more or less shining, elevated, blue dots. On joint 2, a pair of prickly, cylindrical, black horns, transversely arranged, and 0.16 inch long. On joints 3, 10, and 11, a pair of large, dorsal tubercles, transversely arranged, each crowned by a little bunch of 8–12 robust prickles. On joint 5 a pair of similar tubercles, but still larger, of a yellowish color, and mamma-like. On joints 4, 6, 7, and 9, tubercles similar to those on joints 3, 10, and 11, but smaller. On joint 12, four black, prickly, dorsal horns, quadrangularly arranged, and each about 0.03 inch long. Spiracles and legs blackish."—American Entomologist, 1869, vol. I, p. 193.

Chrysalis. Russety, with the sides of the abdomen varied with white, and with a thin, prominent projection on the back.

This insect occurs sparingly in British Columbia, and in Oregon. I saw it flying at the Dalles in July, and found a specimen in the collection of Mr. Johnston, of Portland; so that the earlier stages may be sought for in those districts.

Limenitis Lorquini. Bois.

Larva. General color, olivaceous, shading abruptly into stone-drab in the middle of the dorsal region. Head, deeply furrowed in front, dark fawn-color, covered with small warts, with two protuberances on crown, very rough, the apex of all the warts paler than their base. Second segment, whitish, with olive tint, with three irregular longitudinal blotches of black, not extending into either of adjoining segments; stigmata of this segment large, black, with white center. Third segment, pale olivaceous, swollen into two lumps, from which proceed two horns, very rough and warty, brown in color, and in shape very like small branches of coral. Fourth segment, greenish white, blotched with olivaceous, with two small black spots in front of the center. This segment is produced into two swollen lumps, crowned with a stellar tubercle. The stigmata of three and four are whitish. Fifth segment, olivaceous, with darker patches, wrinkled transversely, with a number of minute metallic blue dots, scattered irregularly. Sixth segment, whitish olivaceous, swollen into two mammiform protuberances, with stellar tubercles on the apex, a greenish dorsal line, and a few metallic, bluish spots, scattered over the disc. Seventh segment, olivaceous, striped longitudinally with paler shades, bituberculated, and with a few metallic blue dots. Eighth segment, whitish, the olivaceous patch here only visible on the anterior portion of the sides, with a small, darker blotch, dorsally edged with two faint, dark lines. Ninth segment, whitish, with green tinge, a dark blotch at base, and two or three faint, blackish dashes. The olive lateral patch is wanting.

Tenth segment, whitish dorsally, olivaceous at the sides. In the white patch are some black waved lines, directed posteriorly, and in the olive parts of this segment are some four or five metallic blue dots. Eleventh and twelfth, exactly alike, olivaceous, with a few paler lines, and two stellar tubercles on each segment, between which are about five metallic blue dots. Thirteenth, olivaceous, with paler stripes, and a rough double tubercle on the anal extremity, brown, warty, similar in color to the head. The stigmata from 5–12 are black, with whitish center. Above them, on 7, 8, and 10, is a black, velvety, ovate spot, and beneath them, commencing at 5, and extending to anal extremity, is a milk-white, waved, lateral line. Under side of body, pale greenish-brown, palest near the junction of the segments. Feet, brownish, with black rings, and with some white bristles springing from their base. Abdominal legs brownish, with very minute white tubercles.

Length, 1.20 inch.

Food plant, willows, and occasionally on oak.

Changed to chrysalis, June 12th. Imago emerged, July 6th.

Thecla halesus. Bdv.

This magnificent insect, the most showy and the largest of our Theclas, is met with occasionally in several localities near San Francisco. The following brief description of its early stages is appended:

"*Larva.* Green, slightly pubescent. Head and scaly feet testaceous. On the back there is a small ray, and on the sides, nine oblique bands of obscure green. At the base of the feet, a marginal ray of greenish yellow. Feeds on *Quercus.*

"*Chrysalis.* Russety, pointed with brown."—Boisduval.

Thecla arsace. Bois.

"*Larva.* Reddish; back, white from the second to the ninth ring, and divided by two parallel, interrupted lines of obscure green. Near the base of the feet, there is a marginal ray of the same color, bordered with white below, and between that and the dorsal rays, a row of seven or eight oblique streaks.

"*Chrysalis.* Reddish before, and the wing envelopes greenish."—Boisduval.

Found, though rarely, in Vancouver Island.

Thecla mopsus. Hubn.

"*Larva.* Greenish, with the back a little more whitish. The anterior and dorsal part has a brown quadrangular space, bifid behind, and marked with four white spots. The three hind rings have a wide white border, edged with brown. Head and feet brownish. Feeds on *Eupatorium coelestinum*.

"*Chrysalis.* Grayish-brown, with a row of yellow, ferruginous points on the sides."—Boisduval.

Found sparingly near Portland, Oregon; at the Dalles, and on Vancouver Island.

LIST OF SPECIES NOTICED IN THIS PAPER.

Papilio Daunus	Chrysalis.
Pieris protodice	Larva and Chrysalis.
Anthocaris ausoniedes	" "
Colias coesonia	Larva.
Terias lisa	"
" *delia*	"
Danais Berenice	Larva and Chrysalis.
Agraulis Vanillæ	" "
Pyrameis Caryæ	" "
Limenitis Misippus	" "
Limenitis Lorquini	Larva.
Thecla halesus	"
" *arsace*	"
" *mopsus*	"

A Tribute to the Memory of George Robert Crotch.*

BY HENRY EDWARDS.

"Died, on the 16th of June, 1874, of consumption, at the house of Professor Lesley, 1008 Clinton Street, Philadelphia, where he passed the last six weeks of his life, George Robert Crotch, M. A., Cantab, son of Rev. Wm. R. Crotch, M. A., Oxon, aged 32 years. Interment at Woodland Cemetery, Philadelphia, U. S. A."

Such was the intelligence conveyed a short time since in the letter of a mutual friend—intelligence which has brought a gleam of sadness to many a heart, and caused a tear to start to many an eye. Though not a member of this Academy, Mr. Crotch was well known to some assembled here to-night, and his early death deserves a passing tribute of respect at our hands. As a naturalist, in his own particular branch of science, he stood deservedly high; and from his young life, just opening as it were with promise, much and valuable work might reasonably have been expected. He has been stricken down in the midst of his enthusiasm, and adds one more name to the long list of those who, while devoted to science, have become its martyrs.

George Robert Crotch was born and educated in Cambridge, England, where his father was a distinguished divine, he himself having also in early life been intended for the church; but when quite a boy he manifested that earnest love for Entomology which in after years became the ruling passion of his life, and unfitted him for other labors. He graduated with considerable honors and became an admirable classic and modern linguist, abilities which won for

* Printed in advance.

him the position of librarian of one of the colleges of his native city. A life of confinement was, however, irksome to him, and giving the rein to his love of adventure, he wandered over the best part of Europe in search of insects, visiting Spain, Portugal, Italy, and the isles of the Mediterranean. He also once undertook a collecting tour through the Canary Islands, and ascended the Peak of Teneriffe in search of specimens, his labors being rewarded by the discovery of many species new to science. In the fall of 1872 he came to America, passing some time in Philadelphia, examining and determining species in various collections, and arrived in California, full of health and spirits, early in the last year. After thoroughly exploring the immediate neighborhood of San Francisco, walking nearly every day for several weeks upwards of twenty miles, he started on a tour through the southern part of the State, taking Santa Barbara, Fort Tejon, San Bernardino and San Diego in his way, wandering even across the boundary into the Mohave Desert, sleeping for several nights after the day's fatigue in the open air, with no other covering than the clothes he wore. Returning to San Francisco early in May, he spent some time at various points of the Sierra Nevada, and in June started on a prolonged tour through Oregon and British Columbia, during which he contracted the disease which has now carried him away. He trusted to his training as a gymnast and to his naturally strong constitution to bear him through the hardships which he encountered, but he was deceived. Nights and days of rough life, with poor and uncertain food, sometimes in cold and inhospitable weather, proved too much even for his strong frame, and soon after his return to the Eastern States his malady declared itself. He had accepted an invitation from Professor Agassiz to take charge of a portion of the insects in the Museum at Cambridge, and was assiduously employed upon their determination and arrangement when he was stricken down. Returning to Philadelphia in April last, he grew gradually worse, and though he himself had hope that the summer would bring a change for the better in his condition, his friends immediately around him knew and felt otherwise. In the last letter I ever received from him, which is dated the fourteenth of May, he says: "No leaving here this summer. I have written for my brother, who I hope will come to me. At present things look bad, and though I eat and drink well, yet the average effect is weaker, and the expectoration won't slacken. This may be a serious thing, though, of course, my constitution is in my favor. Please keep my net and use it—it will be long before I need it again. I should like to see you once more; I shall, some day, I hope. If I could only be out collecting, somewhere, I am sure I should get well." Then, with the ruling passion still strong within the shadow of death, he adds in a P. S.: "Let me know what new things you have taken this year." The iron hand was too strongly pressed upon him, and even his brother and sister arrived too late to receive his parting words. It is, however, gratifying to know that his last hours were soothed by the presence of kind and gentle friends, and that all that earthly love and attention could do was done, to render his passage from the world tranquil and full of peace.

Mr. Crotch was the author of a vast number of papers in various scien-

tific periodicals on the different families of Coleoptera, his knowledge of this extensive and difficult order of insects being wide in the extreme, while his "Revision of the Coccinelidæ" may be regarded as the standard of all the information we possess upon the species of that group. Just previous to his death he had undertaken the revision of the North American Phytophaga, and had already published some valuable information concerning this family. His energy and enthusiasm in the pursuit of the objects of his special study knew no bounds, and the knowledge he possessed of their habits enabled him always to discover new species, even in localities which had previously been subjected to a somewhat strict and careful search. As an instance of his skill as a collector, it may be stated that during the few months he passed on this coast, he added between three and four hundred species to our collections. He had planned a trip to Central America, and subsequently one to the Islands of the Pacific, and to Australia, both of which have been cut short by his untimely death. The grass which covers the grave of George Robert Crotch will grow above the remains of a most able naturalist, a true and generous friend, and an accomplished and genial man.

On the Use of Giant Powder (Dynamite) for Obtaining Specimens of Fish at Sea.

BY A. W. CHASE, U. S. COAST SURVEY.

During the winter of 1873, I made some experiments off the island of Santa Catalina with giant powder, which have some points of interest. They were not undertaken at first as offering any field of research, but for the more utilitarian purpose of obtaining fish for "chowder."

I was, however, so much struck with the variety and number of fish procured, and also with some curious facts connected with the suspension of animation in the nerve centers of the fish stunned, that I wrote to the late lamented Agassiz on the subject. In his reply, which is dated June 18th, 1873, he states that the letter is full of interest, and that the experiments should be continued and varied, and, of course, asked me to send specimens, etc. But further correspondence on a subject which, to me, promised to be exceedingly interesting, was cut short by his death, and the specimens I afterwards obtained are lying in alcohol with the exception of a few that Dr. Steindachner took with him to Vienna.

As you are all doubtless aware, giant powder No. 1 is simply nitro-glycerine, with the addition of an absorbent earthy powder, an infusorial earth obtained in Europe being the principal material used in the factory here. The powder thus prepared has the appearance and consistency of soft putty, and is put up in cartridges the length and shape of an ordinary candle. In using it for explosion in water, the cap is fitted on the end of the fuse, and both buried deep in the soft powder, a string being then tied tightly around the fuse where it comes in contact with the edges of the paper wrapper. The top of the cartridge is then tallowed, and it is ready for use.

I have found that the ordinary water-proof fuse will burn about one foot to

every twenty-five seconds, and, by experiment, that a cartridge will explode in from four to six fathoms with from three to four inches of fuse. I have, however, made no exact experiment on the subject. The shock of the explosion is most severely felt downwards, as the resistance is greater; and the different varieties of sea fish found near the rocky shores of the islands, as a rule, being found on or near the bottom, it is desirable to explode your cartridge about midway between the surface of the water and the rocks beneath, as you thus reach both the deep-lying fish and those, like mackerel and smelt, which swim between.

Let me now describe to you the modus operandi, as practiced by myself off Catalina. I would take a small skiff and pull off to the kelp beds that surround the island. Here, in six or eight fathoms of water the bottom is distinctly visible, the water, owing to the absence of currents or of sedimentary deposits around the rocky shores, being beautifully clear and limpid. Fastening my skiff to the floating weed, I would part the stems and look down into the depths below. It is a most wonderful and interesting study. You see the stems of the kelp rising up from the bottom like twisted pillars, often many being twined together. Through these submarine forest aisles you see great numbers and variety of fish and crustacea. The large vieja, or red-fish, so-called (totally distinct from the red-fish of our markets); the splendidly colored red perch, or mullet, a vivid scarlet; the elegantly-shaped sea bass; the pompino; the smelt and mackerel, in schools, darting hither and thither; and occasionally a great conger eel, uncoiling itself from around some stone that it had selected as an ambush wherein to wait for prey. I have often been so much interested in watching the movements of these finny tribes, that I have forgotten the errand I came on.

But when an unusually large school of fish would swim by, I would quietly light the fuse and drop the cartridge into the water gently.

If the water was, say eight fathoms deep, I would graduate the fuse for explosion at four. The cartridge would slowly sink—generally in a spiral—and a few bubbles of air or smoke arise to the surface.

The fish did not seem, as a general rule, to be much alarmed. Once I remember a large red fish took the cartridge for something good to eat, and reached it just in time to allow a small portion of his tail to reach the surface. When the fire reached the fulminate of mercury, there would be a sudden white flash, then a quick, sharp detonation, the blow striking the bottom of the skiff as if some one had struck it with a hammer.

Then, in a space of time varying from eight to ten minutes, every fish within a radius of forty or fifty yards would slowly come to the surface. Those within the immediate vicinity of the explosion, of course, were killed by bursting the bladder and injury to the large intestines, and had to be speared up from the bottom. Those, however, at a greater distance, would be simply stunned, and could be taken in with a net. Care had to be taken to avoid touching those only slightly stunned until the net was fairly around them, as the slightest blow would arouse them from their torpor.

I found that an ordinary sized red-fish, weighing say five or six pounds, which happened to be ten or twelve yards from the explosion, would remain thor-

oughly stunned about twenty-five or thirty minutes; then, reviving, would die from asphyxia, in a similar manner as if caught with hook and line. Many curious varieties of the smaller fish, many of them of brilliant color, that live around the kelp stems, would be secured by the explosion. These, I do not think could be taken in any other way. The kelp would interfere with nets, and they never take bait. The brilliant red mullet, for instance, (I give only the common names) will not touch bait, and lives in hollows in the rocks or around the kelp, where nets could not be dragged. This fish is far handsomer than the gold-fish of our aquariums.

I am now about to relate what will, perhaps, be called a genuine "fish story"; but as I have, in addition to my own, the testimony of my men to the fact, I give it as it occurred.

I had brought up by an explosion a number of yellow bass fish, weighing about four pounds each. These are delicious in chowder, and so, instead of putting them in alcohol, I had them cleaned, which was done by scaling, removing the intestines, and cutting off the fins and tail. The head, however, still remained joined to the backbone. These fish, from the time they had been taken from the water up to the time of cleaning, remained apparently lifeless. Nor did the removal of the intestines arouse them. They were then taken up to the old barracks, where I was temporarily camped, and hung upon nails driven in the clapboards. Some little time after they had been thus disposed of, one of the men came in and asked me to go out and look at the fish. I did so, and found every individual bass slapping around in as lively a manner as if he had been freshly caught and hung up.

They had, in fact, recovered from the explosion, and proceeded to die in the common fashion. I took one down and broke the backbone where it joined the head. Its struggles ceased instantly, thus showing that the vital force had been arrested in the nerve centers and brain at the time of explosion, and when the effect had passed away that the fish had resumed a galvanic life.

It was probably about half an hour from the time of explosion when this occurrence took place. I have not been able since, however, to secure the same result, although I must state that the only time since then that I have tried the experiment was on the Oregon coast, where I brought up a school of salmon, all of which were pickled for Agassiz. These fish were, however, too close to the explosion, as they were killed outright.

In referring to the use of these cartridges, I would state that I have carefully avoided transgressing any of the laws on the subject against destruction of trout or other valuable fish of the fresh water streams; but as the fish of the sea are unlimited in number, I do not see that any objection, beyond the danger of accident to the operator, can be urged against their use in the ocean, and it certainly offers a means of securing rare specimens not obtainable by net or line.

In reference to the fishing off Catalina Island, I would state that it in my mind constitutes one of the principal values attached to this property so lately deeded by Mr. Lick for benevolent and scientific purposes.

There are two excellent harbors, one on each side of the tranverse gap in the mountain chain traversing it, called the Isthmus. On this is located a large frame building, erected by the Government during the late war, which might be converted into a hotel, and with boats in each harbor, and a little steamer to ply back and forth to San Pedro, be made a place of great resort. There is excellent sea bathing from several of the sandy beaches in the little coves, and the dreaded stingaree, the pest of the main shore, is not found there. For a school of natural history like that at Penikese, the island would be excellently adapted.

The President announced that at a future meeting he would communicate in detail the results of the sounding expedition to Japan from San Diego. Commodore Belknap had forwarded to him all the information necessary.

The President stated that George H. Mumford had telegraphed to him, stating that he is making arrangements by which he hopes to be able to accede to the request to transmit musical sounds from the office in New York to the rooms in the Academy.

The President communicated to the Academy some of the results obtained in ascertaining altitudes by leveling, vertical angles, and barometric measures. The experiments were conducted by himself and Charles A. Schott, of the Coast Survey, and they lasted seven days. The altitude of Ross Mount was ascertained from Bodega Head, by the process known as double zenith distances, to be 598.74 metres; by leveling, 598.53 metres; and by barometer, 598.80. The barometer used was the Smithsonian. It was found over the whole series of observations that seven o'clock in the morning was the best time to use the barometer. At one o'clock in the afternoon the difference noted in the barometer, on the average, amounted to thirty-seven feet. The heat radiated from the earth did not appear to affect the atmosphere on the line of sight between the Head and Ross Mount, the air being almost constant in its temperature. Close to the ground, however, the temperature changed considerably. In this respect, varying results might be expected in other localities.

Regular Meeting, July 20th, 1874.

President in the Chair.

Fifty members present.

E. Stevens was elected a resident member.

Donations to the Museum: From J. S. Lawson, of the Coast Survey, specimens of *Verillia Blakei*, preserved in glycerine, in a heavy glass tube, the gift of Professor Davidson. From John Williamson, Secretary of the Acclimatization Society, a collection of fish, embracing eight species, from Lake Tahoe: there are ten varieties of fish found in the lake. From E. Stevens, four specimens of iron ore, and one of fossil earth, from the Sublette mines, Del Norte County, ten miles northeast of Crescent City: the fossil earth occurs in great beds, at about 2,000 feet altitude. From Eugene Gillespie, of Cape St. Lucas, through Mr. Dameron, a box of the leaves and berries of a plant said to be poisonous; accompanying the specimen was a letter describing the plant and the symptoms exhibited by a child whose death was caused by contact with, or eating the berries of the shrub. The Alaska Commercial Company presented a skeleton of a large Alaska seal. Dr. Blake presented specimens of mica, containing potash, lithium, and chromium, with which gold was associated in considerable quantity, found at Granite Creek, near Coloma—the only specimens, he believed, in which gold had been obtained in any other vein of mineral than quartz: the specimens did not occur continuously, but in patches, and occurred in an altered porphyritic rock; they were a very beautiful microscopic study, and the formation indicated that the gold must have been deposited by aqueous solution between the thin flakes of mica. From Professor George Davidson, specimen of *Echinarachnius eccentricus, of* Escholtz. J. P. Dameron presented specimen of *Velella.*

A bottle of Sonorous Sand, from the Island of Kaui, of the Hawaiian group, was received from W. R. Frink, with a letter describing its peculiarities, as follows:

"The bank, which is composed of this sand, commences at a perpendicular bluff at the southwest end of the island, and extends one and a half miles almost due south, parallel with the beach, which is about one hundred yards distant from the base of the sand-bank. This sand-drift is about sixty feet high, and at the extreme south end the angle preserved is as steep as the nature of the sand will permit. The bank is constantly extending to the south. It is said by the natives that, at the bluff, and along the middle of the bank, the sand is not sonorous. But at the extreme south end and for half a mile north, if you slap two handfuls together, there is a sound produced like the low hooting of an owl—more or less sharp, according as the motion is quick or slow. Sit down upon the sand, and give one hand a quick, circular motion, and the sound is like the heavy bass of a melodeon. Kneel upon the steep incline, extend the two hands, and clasp as much sand as possible, slide rapidly down, carrying all the sand you can, and the sound accumulates as you descend, until it is like distant thunder. In this experiment the sound was sufficient to frighten our horses, fastened a short distance from the base of the drift.

"But the greatest sound we produced was by having one native lie upon his belly, and another taking him by the feet, and dragging him rapidly down the incline, carrying as much sand as possible with them. With this experiment the sound was terrific, and could have been heard many hundred yards distant. With all the experiments that were made, it seemed the sound was in proportion to the amount of sand put in motion with a proportionate velocity. Another consideration seems requisite, that is, its perfect dryness. The dry sand would sound on the surface, where six inches beneath it was wet; but if any of the wet sand became mingled with the dry, its property of sounding ceased at once. The sand appears to the eye like ordinary beach sand, but ordinary beach sand will not produce the sounds. It has been said that it lost its sonorous properties when taken away from the bank. But I can discover no diminishing of its sonorous qualities, even with the bottle uncorked, and we have had rain frequently, and an atmosphere more than ordinarily moist for this time of year. Perhaps, if exposed to a

very damp atmosphere, it might absorb moisture enough to prevent its sounding."

Donations to the Library: Senator Cornelius Cole presented one hundred volumes of books, and forty pamphlets, mostly public documents. Mr. Amos Bowman presented his report on the Georgetown Divide. D. D. Colton presented Adams' Map of History.

One case of books was received from the Smithsonian Institution, containing the following: Records of the Geological Survey of India, Vol. VI., Parts 1 and 3; Memoirs of the Geological Survey of India, Calcutta, Vol. I, Part 1, Vol. IV., Parts 3 and 4 (Palæontologia, India); Memoirs of the Geological Survey of India, Vol. X., Part 1; Bulletin de la Société Imperiale des Naturalistes de Moscow, No. 2, 1873; Bulletin de la Société des Sciences Historiques et Naturelles de Lyonne, Vol. XXVII., 1873; Two volumes in Russian language; Jahrbuch der K. K. Geologischen Reichsanstalte, Wien, 1873; Oversight over det R. Danske Videns Kabirnes Selskabs Forhandlinger og dits Medlemmers Arbejder i Aarut, Copenhagen, 1873; Les Cristalloids Complexes a Sommit Etoilé, par Le Cti Leopold Hugo, Paris, 1872; Introduction a la Geometrie description des Cristalloides, par Le Cti Leopold Hugo, Paris, 1874; Sitzungs-Berichte der Naturwissenschaftlchin Gesellschaft, Isis en Dresden, 1873; Mittheilungen aus dim Konigl Mineral Museum in Dresden für dii Jahre, 1872 and 1873; Extraite des Annales de la Société Entomologique de Belgique, Vol. XVI., 1873; Journal de la Société d'Horticulture, 1870 and 1872; Achtundfunfziyster Jahrisbericht der Natur, Gesellschaft in Emden, 1872; Bulletin de la Société des Sciences Naturelles de Neuchatel, Vol. IX., 1872; Nachrichten von der G. Gesellschaft der Wissenschaften und der Georg-Auguste-Universitat aus der Jahre 1873, Gottingen. Verhandlungen des Natur Vereins der Preussischen Rheinlande und Westphaliens, Bonn, 1872 and 1873; Archives Neerlandaises des Sciences Exactes et Naturelles, Paris, 1873; Neerderlandsch Meteorolog, 1868 and 1872; Suggestions on a Uniform System of Meterorological Observation, Utrecht, 1872; Verhandlunger des Botanischer Verein der Provinz Brandenburg, Berlin, 1872; Verslagen en Medederlingen der K. Akademie van Westenschappen, Amsterdam, 1873; Jaarbuck van de K. Akademie van Wettenschappen, Amsterdam, 1872; Ganda Domestica, Amsterdam, 1873; Memoires de la Société Nationale des Sciences Naturelles de Cherbourg, Vol. XVII., Paris; Catalogue de la Bibliötheque de la Société Nationale des Sciences de Cherbourg, 1873; Bericht über die Senckenbergesche Naturforschende Gesellschaft, Frankfurt, 1872 and 1873; Tenth Annual Report of the Belfast Naturalist Field Club, 1872–1873; Annales de la Société Malacologique de Belgique, Vols. VI. and VII., 1872 and 1873, and Vol. II., 1873; Memoirs de la Société de Physique et d'Historie Naturelle de Geneva, Vol. XXIII., Part 1; Sitzungsberichte, der K. Akademie der Wissenchaften, Wien, 1872 and 1873; Mikrogeologische Studien, etc., Christian Ehrenburg, Berlin, 1872; Bulletin Meterologique de L'Observatorie de L'Universitie Upsal, 1873, Vol. V.; Nova Acta Regia Societates Scientiarum Upsalensis, Vol.

VIII., fasc. 2, 1873; Abhandlungen der Mathematisch-Physikalesaben Classe der Koniglich Bayerischen Akademie der Wissenschaften, Munichen, 1873 and 1874; Verzerchniss der Mitzlieder der K. B. Akademie der Wissenschaften, 1873; Rede in der öffenthichen Zitzong du K. Akademie der Wissenschaften, am 25 Juli, 1873; Der Antheil du K. Bayerischen Akademie der Wissenschaften and der Entwickenblung der Electriutatslchere, Munich, 1873; Annalen der K. Sternwarte, Vol. XIX., Munichen; Sitzungsberechte, der Mathematische-Physikalischen Classe du K. B. Akademie der Wissenschaften, Vol. 1, 2, and 3, Munich, 1872. On some remarkable forms of Animal Life from the Great Deeps off the Norwegian Coast, by George Ossian Sars, Christiania, 1872. Die Pflanzenwett Norwegens, ein beitrag zur Natur- und Culturgeschichte Nord-Europas, von Dr. F. C. Schübeler, Christiania, 1873. Uber die Nervenendigung an den Tasthaaren der, etc., von Dr. J. Schöbl, Prag, 1872. W. G. Horner's eigentliche Aufflösungsweise Algebraischer, etc., von Dr. Wilh. Matzka, Prag, 1871. Ueber Graphische Integration, by Josef M. Sōlin, Prag, 1872. Die Tangentialwage und ihre Anwendung zur Bestimung, etc., von K. W. Zenger, Prag, 1871. Ueber Fruchtsladien Fossiler Pflanzen, etc., by Otaker Feistmantel, Prag, 1872. Ueber die Bestimung der Vergrösserung und der Gesichtsfeldes, etc., by Dr. A. von Waltenhofen, Prag, 1871. Steinkohlenflora von Kralup, in Bohemia, von Otaker Feistmantel, Prag, 1871. Abhandlungen herausgegeben von Naturwissenschaftlichen Vereine zu Bremen, 1873. III. Bd. III. Heft. (Construction of Yachts.) Anvisning til Konstruktion af Lystfartöier og Bade, af C. Archer, Christiania, 1873. Forekomster af Rise I Visse Skifere I Norge, Med 3 plancher og flore træsnit af Amund Heland, Christiania, 1873. Norsk Meteorologisk Aarbog for 1871, Christiania, 1872. Budget for Marine-Afdelingen undr Marine- og Post-Departementet, Christiania, 1872. Lov om Poftvœfenet, Christiania, 1871. Oversigt ober Statstasfens Indtægter og Udgifter, etc., 1872, 1873. Mémoires de L'Academie Imperiale des Sciences de St. Petersbourg, Tome 18, No. 8, 9, and 10; Tome 19, No. 1 to 7. Bulletin of same, (17 Feuilles 33–36) (Feuilles 27 to 32); Tome 18 (Feuilles 1–7); Tome 18 (Feuilles 8–15). Mémoires de la Société de Physique et D'Histoire Naturelle, Geneve, 1873. Elektromagnetische Untersuchungen, etc., von Karl Domalip, Prag, 1872. Erzeugnisse Mehrdeutiger Elementargebilde, etc., von Dr. E. Weyr, Prag, 1871. Uber einen Satz der Wahrscheinlichkeits-Rechnung, etc., von Dr. J. Dienger, Prag, 1872. Beiträge zur Theorie der Curven 3 und 4 Ordnung, von C. Küpper, Prag, 1872. Bulletins de L'Academie Royale des Sciences, etc., Bruxelles, 1871, Tome 32; 1872, Tomes 33 and 34. Acad. Royale de Belgique, extracts, etc.; Observations des Phenomenes Periodiques Pendant L'Anné 1870. Annuaire de L'Acad. Royale, etc., de Belgique, 1875 and 1872; two vol.; Bruxelles, 1873. Acad. Royale de Belgique, Centiéme Anniversaire de Foundation; Tome 1st and 2d, (1772–1872) Bruxelles, 1872. Tables de Mortalité et Seur Developpement D'Apres Le Plan d'une Statistique Internationale et Comparée, etc., Bruxelles, 1872. Annales Meteorologiques de L'Observatoire Royale de Bruxelles, by A. Quetelet, Bruxelles, 1871. Norges Officielle Statistik, Christiana, Udgiven I. Aaret, 1870

F. No. 2; Ibid, 1871, F. No. 1; Ibid, 1872, C. No. 1 and 2; Ibid, 1873, C. No. 2–10; Ibid, 1873, A. No. 1; Ibid, 1872, B. No. 2; Ibid, 1872, D. No. 1. Reale Instituto Lombardo di Scienze e Lettere, Vol. 5, 1872 (complete); Vol. 4, fascicolo 14 to 20; Vol. 6, fascicolo 1 to 5; Milano. Jarbuch der Raiserlich, Koniglichen Geologischen Reichsanstatt, Wien, 1873; 23 Band, No. 2, April, May, and June. Memoires de la Société Royale des Sciences de Liege, 1873. Historia e Memorias de Academia Real Das Sciencias de Lisboa; tomo 4, parti 2, 1870; tomo 4, parti 1, Lisboa, 1871: tomo 2, parti 1, 1857; tomo 2, parti 2, 1861; tomo 3, parti 1, 1853; tomo 1, parti 1, 1854; tomo 3, parti 1, 1863; tomo 1, parti 2, 1855. Correspondenzblatt des Naturforscher-Vereins zu Riga, 1872. Die Bildung des Knochengewebes, Leipzig, 1872. Oversight over det Konelige Danske Videnskabernes Selskabs, Copenhagen, 1872. Transactions of the Edinburgh Geological Society, Vol. 2, p. 2. Callecção das medalhas e condicorações Portuguezas e das estrangeiras com Relação a Portugal; Pertencente as tom. III part. II das Memorias da Acad. Real das Scien. de Lisboa, by Manuel Bernardo Lopes Fernandes. Beretning om den Almindelige Udstilling for Tromso Stift, Cristiania, 1872. On the Structure of Brontotheridœ, by Prof. Marsh, Jan., 1874. Recherches sur la Chronologie Egyptienne, etc., par J. Lieblein, Christiania, 1873. Eloge de Jean Théodore Lacordaire, par M. Edourd Morren, Liege, 1870. Introduction a L'Etude de la Nutrition des Plants, Bruxelles, 1872. Bulletin du Congrés Internationale de Pomologie, etc., Gand, 1863. Projet de Chur un Jardin D'Acclimation, etc., Liege, 1863. Uebersicht der Aemter-Vertheilung und Wiss. Thätigkert des Naturwiss. Vereins zu Hamburg-Altona in Jahre 1871. Abhandlungen aus dem Gebiete der Naturwissenschaften, herausgegeben von dem Naturwiss. Verein in Hamburg; Hamburg, 1872. Abhandlungen der Naturforschenden Gesellschaft zu Halle—original aufsätze aus den Gebieter der Gesammten, etc., Halle, 1873. Schriften der Königlichen der Physikalisch-ökonomischen Gesellschaft zur Königsberg, 1872. On the Rise of Land in Scandinavia, by S. A. Sexe, Christiana, 1872. Etude sur La Naturalisation de quelques Vegetaux Exotiques, a la Montagne St. Pierre liz-Maastricht, par Andre De Vos, Gand, 1872. Forhandlinger i Videnskabs-Selskabet, I Christiani, Aar., 1871. Transactions of the Albany Institute, Vol. 7, 1872. Ertekezések a Természettudományok Köréböl, Pest, 1871. Reale Instituto Lombardo di Scienze e Lettere, Vol. 4, Milano, 1871. Bulletin de la Société Impériale des Naturalistes de Moscou; Moscou, 1873 and 1872. Bemerkungen und Berichtigungen zu Kittel's und Kriechbaumer's Systematischer Uebersicht der Fliegen, etc., Nuremberg. R. Comitato Geologico D' Italia, Bollettino No. 3 e 4, Tirenze, 1873. Table Generale de la Belgique Horticole, 8vo., Gand, 1871. Actes de la Socié é Helvetique des Naturales, etc., Fribourg, 1873. Report on a Topographical Survey of the Adirondack Wilderness of New York, Albany, 1873. Proceedings of the Philosophical Society of Glasgow, Vol. 8, No. 2, 1872–73. Dur Zoologische Garten, Nos. 1 to 6, Frankfort, 1873. Sitzungsberichte der Königl. Bohmischen Gesellschaft der Wissenschaften in Prag, Janu–Juni, and Juli–Dezember, Prag, 1872. Beitrage zur Physikalischen Geographie der Presburger Gespauschaft, von Dr. G. A. Kornhuber, Presburg, 1865.

Professor Davidson communicated to the Academy the general results of the recent survey made by Commander Belknap, of the United States steamer *Tuscarora*, on the proposed southern route for the telegraph cable from this coast to Japan; his remarks were illustrated with charts and drawings. In the soundings from San Francisco to San Diego, a great many off-shore lines were run. Ninety miles off Point San Luis the depth increased to 2,000 fathoms, with gray greenish ooze at the bottom, aud a temperature of a little over 32 degrees. Off Cape Mendocino a plateau was found, with a depth of 2,500 fathoms. Off San Nicolas, at the distance of 33 or 34 miles, the depth was 2,000 fathoms. Down the California coast the ooze became greenish, until San Diego was approached, and on the plateau off there a greenish yellowish ooze was obtained. Thence across to Honolulu the ooze was yellowish, then yellowish brown, and finally brown near Honolulu. In all cases the signs of former life brought up were the same as those obtained on the Northern Pacific Coast.

To Honolulu the distance is 2,200 miles. The bottom averages 2,565 fathoms in depth, or 15,510 feet, and the average temperature is 33 6-10 deg. Much more than one-half of this water along the ocean-bed has a temperature of 35 degs. only; above this came a stratum of water heated to 40 deg., and above this again, water heated to 50 deg. Upon a calculation of the volume of water between this coast and Honolulu, along the line of soundings, he estimated the quantity at 1,858,000 cubic miles. Of this, 1,046,000 cubic miles range in temperature from 33.6 to 35. Between the temperature of 35 and 40 there are 582,000 cubic miles; from 40 to 50 degs., 180,000 cubic miles; and from 50 degs. to the highest temperature, which is found over at Honolulu, 73½ degs., the volume is 100,000 cubic miles. In other words, the film of surface-water ranging from 59 to 73 6-10 is only one-tenth of the mass of water below it. Apparently, the grade is very steep at Honolulu and off San Diego, but in reality it never exceeds one foot in twenty-six; no greater impediment to cable-laying is encountered from Honolulu to Bonin Island, where there is the greatest depth of the route, 3,262 fathoms, nor thence to Japan. In sounding to Bonin several submarine mountains were discovered,

and the lead came up twice in a battered state, as if it had struck rock. The total distances along the route are: From Honolulu to San Diego, 2,240 miles; from Honolulu to Peel Island, 3,273; and from Peel Island to the coast of Japan, 480 miles; being 5,993 nautical miles, or 6,950 statute miles. This does not allow for any slacks in laying the cable.

Pacific Coast Lepidoptera, No. 6.—Notes on the Earlier Stages of Ctenucha Multifaria, Boisduval.

BY HENRY EDWARDS.

Through the kindness of Dr. Blake, of this Academy, I have an opportunity to call attention to the earlier stages of one of our rarer day-flying moths, (*Ctenucha multifaria*) the transformations of which were previously quite unknown. Dr. Blake captured a female recently at Crystal Springs, San Mateo County, in the act of depositing her eggs upon the leaves of the snow berry (*Symphoricarpus racemosus.* Michx). The caterpillar may therefore hereafter be sought for upon that plant.

Egg. Spherical above, much flattened at base, dull cream white, slightly glossy. Attached to the upper surface of the leaf, and deposited separately, in this respect differing from the species known in the Atlantic States as *Ctenucha virginica*, the eggs of the latter being found in small clusters, adhering compactly together. The young caterpillars emerged from the egg in about twelve days, and presented the following appearance:

Head, rather large, pale chestnut brown. Body, dull cream white, with numerous concolorous hairs, those of the extremities being the largest. Along the head in front is a faint, slightly waved black line. Each segment is provided with a row of black dots, about four to each segment, becoming fainter towards the posterior extremity.

Though supplied constantly with fresh food, and watched with every care, I regret to say that my young larva all died within a week, so that the mature caterpillar of this interesting insect still remains unknown; but during a recent visit to Monterey, I found adhering to the trunk of a pine tree a singularly formed cocoon, so remarkable in its construction as to cause me to watch for the emergence of the perfect insect with considerable interest. I had the satisfaction in a few days of discovering that it was the present species, and have pleasure in appending the following description:

Chrysalis. Tubular, slightly thickened about the anterior portion of the thorax. Shining, pitchy, with a double line on the thorax, some streaks on the wing cases, the antennæ, mouth parts, and the base of each abdominal segment, bright chestnut color. A few very short hairs are scattered about the upper side of the abdomen.

Length, 0.75 inch.

The cocoon was formed of rather long hairs, pale fawn color, sparsely mingled with black, which appear to rest on each other, and to be irregularly placed. The upper portion was drawn up into a pointed ridge and gable-shaped, like the roof of a house, while the base was spread out, and attached very loosely to the trunk of the tree, compelling me to cut away a piece of the bark in order to secure the cocoon. The structure of the chrysalis case of this genus appears to be peculiar. According to Dr. A. S. Packard, "it is formed out of the hairs of the caterpillar, without any silken threads being employed, as far as could be observed by microscopical examination. The hairs of these insects are thickly armed with minute spinules, so that by being placed next to each other, they readily adhere together, no silk being spun throughout the entire operation."

This insect, which is at present rare in collections, is found in its perfect state among reeds in rather marshy districts, and may be known by its bright bluish black color, with crimson marks on the head and thorax. Unless in very hot sunshine, it is a remarkably sluggish insect, and feigns death when captured.

A still scarcer, but closely allied species, described by me in these Transactions as *Ctenucha Walsinghamii*, was taken by Lord Walsingham some three years since in Southern Oregon. I have now to record the capture of two other specimens of this rare insect by Mrs. Howard Coit, in Napa County, and by her kindly added to my collection. This indicates rather a wider range than belongs to most members of the genus, as they appear from our present knowledge of them to be remarkably local.

The members of the Academy were invited by Mr. Stearns, on behalf of the Board of Regents of the University of California, to attend the commencement exercises at Berkeley. A vote of thanks was passed to the Regents for their courtesy.

Professor Davidson reported that the trustees had held a number of meetings with regard to framing a new constitution, and had called in to their aid Judge Curry, R. C. Harrison, and Samuel Wilson. They hoped to present to the Academy at the next meeting such amendments to the constitution as were required to guard against mistakes in the management of their property.

Regular Meeting, August 3d, 1874.

President in the Chair.

On ballot, the following resident members were elected: Hon. Cornelius Cole, Prof. T. Guerin, James Faulkner, and Carl I. Schneider.

The following, purchased for the museum by Capt. C. M. Scammon, were submitted. Baleen of the sulphur bottom whale (*Sieboldius sulphureus* of Cope) taken at Santa Cruz; Baleen of Bowhead (*Balæna Sieboldii* of Linnæus). Baleen of Right whale (*Balæna Sieboldii* of Gray). Baleen of California gray whale (*Rachianectes glauca* of Cope). Earbone of a right whale, taken on coast of Alaska in 1873. Earbone of the *Orca* or Killer, a cetacean of the dolphin family. Skull of a dolphin, with several vertebral plates, taken off the coast of California, Oct. 29th, 1873. Skull of porpoise (*Lagenorhynchus obliquidens* of Gill). Skull of porpoise, name undetermined. Skull of Bay porpoise (*Phocæna vomarina* of Gill), the least in size of the entire whale tribe inhabiting the Pacific North American Coast. Jaw of a white-headed or mottled grampus (*Grampus Stearnsii* of Dr. Dall). Bunch of warts taken from the head of *Balæna Sieboldii*. These warts are called by the sailors "rose buds." Piece of the right whale's "bonnet" (*Balæna Sieboldii*) taken on the Northwestern Coast. Two specimens of walrus hide. Fifteen jars of alcoholic specimens of various parts of cetaceans, with many of the parasites peculiar to them; and also specimens of crustaceans, used as food by the whales. Henry Edwards presented specimen of *Myriapod*, from the Hawaiian Islands, and a fresh water crustacean from the Dalles, Oregon. Mr. McHenry presented a piece of wood covered with moss, from King County, W. T. Mr. Lorquin presented *Bucephala albiola*, or butter ball duck, and *Querquedula cyanoptera*, or blue-winged teal. J. R. Scupham presented small shells collected on the Promontory Mountains, Utah. Mr. Gruber presented about twenty specimens of birds.

The order of business was suspended, and the President presented to the Academy on behalf of the Board of Trustees, the amendments to the Constitution heretofore offered, with a report from that Board that they had amended the same, and recommending the adoption by the Academy of the same as amended by them, as and for the Constitution and By-Laws of the California Academy of Sciences, in lieu of those now existing.

The following are the amendments to the Constitution as reported from the Trustees for adoption:

ARTICLE I.

NAME.

SECTION 1. This Society shall be known as the CALIFORNIA ACADEMY OF SCIENCES.

ARTICLE II.

MEMBERS.

SECTION 1. The Academy shall consist of resident, life, and honorary members, who shall be elected in the manner hereinafter prescribed.

SEC. 2. Each applicant for life, or resident membership, must be proposed in writing, at a stated meeting of the Academy, by two or more resident or life members; and the name, occupation, and residence of the applicant thus proposed shall be posted in a conspicuous place in the hall of the Academy for not less than one month from the date of proposing. After the name of an applicant for membership has been so proposed, the Council shall, at its next regular meeting, determine by ballot the eligibility of the person proposed. If the Council shall decide that the person proposed is worthy of membership, it shall so report at the next stated meeting of the Academy, at which time he shall be balloted for by the Academy.

No person shall be elected to membership in the Academy during the month preceding the Annual Election.

Every person elected to membership shall pay the initiation fee and the first quarter's dues within one month after receiving notice of his election, and shall sign the Constitution.

SEC. 3. If any applicant for membership has not been reported upon favorably by the Council, or has been rejected by the Academy, his name may be again proposed at any time after the expiration of one year from the date of his rejection.

SEC. 4. Honorary members shall be elected only at the annual meeting, and must have been proposed by the Council not less than two months before such meeting, and the names of the candidates posted in a conspicuous place in the hall of the Academy for that time.

Each candidate for life, resident, or honorary membership must, to be

elected, have received the votes of at least four-fifths of the members voting, and no more than one candidate can be voted for at one ballot. No election shall be declared unless twenty votes have been cast, and in such case the ballot shall be taken at the next stated meeting.

SEC. 5. Any member may, at any time after his election, become a life member by paying into the treasury of the Academy the sum of one hundred dollars, and notifying the Recording Secretary that he desires to be enrolled as a life member. The Council shall have the privilege of nominating for election for life membership at the annual election, such persons as have rendered valuable services to the Academy; such elections not to exceed two annually.

Correspondents of the Academy shall be appointed by the Council for one year, and shall have the privilege of attending the meetings and visiting the library and museum, and of reading and communicating papers to the Academy.

SEC. 6. The business of the Academy shall be managed exclusively by the resident and life members, from whom the officers of the Academy shall be elected.

SEC. 7. The number of honorary members shall not exceed fifty, of which thirty shall be residents and citizens of the United States, and twenty of foreign countries.

SEC. 8. Any member may be expelled from the Academy for cause, and after due hearing, by a vote of two-thirds of the members present and voting. But proceedings for such expulsion can be conducted only at a stated or adjourned meeting. The accused shall have the right to be present at trial, but must withdraw when the vote for expulsion is ordered.

A member shall not be expelled unless at least twenty members vote for his expulsion.

A person expelled from the Academy shall forever thereafter be ineligible for membership.

ARTICLE III.

TRUSTEES.

SECTION 1. There shall be elected annually seven Trustees, who shall have charge and management of the estate and property belonging to this Society, and shall transact all affairs relative to the temporalities thereof.

SEC. 2. Immediately after entering upon their term of office, the Trustees shall organize by selecting one of their number as President of the Board, and shall appoint a Secretary to keep the record of their proceedings, and perform such other duties as they may require.

SEC. 3. The Trustees shall have power to adopt such By-Laws and Rules as shall not be inconsistent with the provisions of this Constitution, for the management and regulations of the affairs and property intrusted to them and under their control; the times and manner of conducting their meetings and of transacting business thereat; and the government and conduct of the persons appointed by them to fill any office or position. They shall require from the Treasurer, Librarian, and Director of the Museum, and from any person who may be appointed by them to any position of trust, such bonds as in their opinion shall be a security to the Society for the faithful discharge by him of his duties.

SEC. 4. The Trustees shall select some bank in the city of San Francisco as the depository of the funds of the Academy, and shall cause all moneys received by them, or by any one of them, to be deposited in such bank in the name of the California Academy of Sciences. The bank selected by them as such depository may be changed whenever the Trustees shall deem it expedient. No moneys shall be withdrawn from said bank except upon the written order and direction of the Trustees, and no disbursement shall be made except upon demands that have been properly audited by them, and for which their warrant shall have been drawn, signed by the President and Secretary of the Board of Trustees, and countersigned by the Treasurer of the Academy. They shall cause suitable books of accounts to be kept, which shall at all times clearly show all their transactions, receipts, and disbursements. At the annual meeting they shall present to the Academy a detailed statement of all their transactions during the preceding year, together with vouchers for all payments made by them, and a full report of all property, real and personal, held by them, and of the condition of the Corporation.

SEC. 5. Whenever the Trustees shall have in their hands funds that in their opinion are not needed for the immediate use of the Academy, they shall have the power to loan the same in the name of the Corporation upon such terms as they may deem advisable.

No loan, however, shall be made except the same shall be secured by mortgage of unincumbered real estate in the City and County of San Francisco, the value of which, exclusive of all improvements, shall in the judgment of the Trustees be twice the amount of the loan; or by a pledge of bonds of the State of California, or of the City and County of San Francisco, whose par value shall be double the amount of the loan.

The funds of the Academy shall not be loaned to any of its Trustees, nor shall any loan be made except upon the vote of not less than five of the Trustees, entered upon the record of their proceedings, and specifying the amount, terms, and security, and the person to whom the loan is made. If any loan shall be made contrary to the provisions of this section, the Trustees making the same shall be individually and severally liable to the Corporation for the amount so loaned.

SEC. 6. The Trustees shall have power, if in their judgment it is advisable, to invest any of the funds of the Academy not needed for immediate use, in bonds of the State of California, or of the City and County of San Francisco. Such investments, however, shall be made only by the unanimous vote of all the Trustees, entered upon the record of their proceedings, and specifying the amount and character of the investment.

SEC. 7. The Trustees shall have the custody of the corporate seal of the Academy, and shall affix the same to all contracts entered into by them in the name of the Corporation.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of the Academy shall be a President, First and Second Vice-Presidents, a Corresponding Secretary, a Recording Secretary, a Treasurer, a Librarian, and a Director of the Museum, all of whom must have

been life or resident members for three years previous to their election. The officers of the Academy shall constitute a Council for the transaction of such business as may be assigned to it by the Constitution and the Academy. The President of the Academy shall be Chairman of the Council. Surplus publications and exchanges of specimens shall be under the control of the Council.

The Council and officers and members are prohibited from incurring any indebtedness on behalf of this Society, unless authorized by the Trustees.

SEC. 2. The Trustees and Officers of the Academy shall be elected by ballot on the day of the annual meeting, for the term of one year. Their term of office shall commence on the third Monday in January, and continue until their successors are elected and qualified. Before the stated meeting of the Academy on the first Monday of December, the Council and Trustees shall meet jointly to select a Nominating Committee of five persons from among the members of the Academy not holding office, and this Nominating Committee shall prepare and present to the Academy, on the stated meeting of the third Monday in December, a ticket, naming one candidate for each office to be filled for the ensuing year, and thereupon this ticket shall be posted in a conspicuous place in the hall of the Academy. Other tickets may be presented, and other candidates may be balloted for at the annual election. At the stated meeting on the third Monday in December, the Academy shall appoint two Inspectors and two Judges of Election, who shall have the charge of the ballot-box, and shall conduct the election, on the day of the annual meeting. The ballot-box shall be kept open from the hour of nine A. M. to six P. M. to receive the ballots of the members having the privilege of voting, and a register of those who vote shall be preserved. No member shall vote at the annual election who is delinquent in the payment of his dues for any portion of the preceding year. At the close of the election the Judges shall announce the number of ballots cast for each candidate, and the candidate who shall receive a plurality of the votes cast for the office for which he had been nominated shall be declared duly elected.

SEC. 3. The President of the Academy, or in case of his absence or inability to serve, the First Vice-President, or in case of his absence or inability to serve, the Second Vice-President, shall preside at the meetings of the Academy. The President shall name all committees, excepting such as are otherwise especially provided for, and shall have a supervisory direction of the other officers of the Academy. At the annual meeting he shall make a report upon the condition and progress of the Academy, and shall also announce the deaths of members that have taken place during the year.

SEC. 4. The Recording Secretary shall keep a record of the proceedings of the Academy; shall receive and refer to the Publication Committee the papers presented for publication; shall furnish to it an abstract of the proceedings of the Academy; and shall duly engross and sign the minutes of each meeting before the next stated meeting. He shall give suitable notice of the time and place of all meetings of the Academy. He shall keep a duly classified list of the members, and shall attend to such other business in his department as the Academy or President may direct. He shall notify members of their election, and furnish them with diplomas.

SEC. 5. The Corresponding Secretary shall conduct the correspondence with societies and individuals, but shall submit all such correspondence to the Presi-

dent for his approval and signature. He shall preserve copies of the correspondence, which shall be kept in the Hall of the Academy, and shall be at all times open to the inspection of the members of the Academy. He shall distribute the publications of the Academy to the members and to the societies that are entitled to them.

SEC. 6. The Treasurer shall receive all the funds of the Academy, and shall deposit the same, in the name of the California Academy of Sciences, in such bank as may be designated by the Trustees, and shall not disburse any funds except under the direction of the Trustees. He shall collect all dues from members, and keep books showing a full account of receipts and disbursements. He shall furnish the Trustees and the Recording Secretary, whenever required, a list of members entitled to vote. He shall not enter upon the duties of his office until he shall have given such bonds as the Trustees may require. He shall be subject to removal by the Trustees for cause.

SEC. 7. The Librarian shall have charge of the Library, and shall enforce such rules for its management as may be drawn up by the Council. He shall not enter upon the duties of his office until he shall have given such bonds as the Trustees may require, and shall be subject to removal by them for cause.

SEC. 8. The Director of the Museum shall have the general care and oversight of the museum and scientific collections of the Academy, assisted by such curators as may be appointed by the Council. He shall be subject to such rules for the management of the museum and scientific collections as may be prescribed by the Trustees. He shall not enter upon the duties of his office until he shall have given such bonds as the Trustees may require, and shall be subject to removal by them for cause.

SEC. 9. All officers shall make yearly reports to the Academy, to be presented by the President at the annual meeting; and special reports whenever called upon by the Trustees or the Academy.

SEC. 10. In case of vacancy in the office of Trustees, the remaining Trustees shall fill such vacancy. In case of vacancy of any other officer, the Council shall fill such vacancy. The person selected to fill any vacancy shall hold the office until the third Monday in January thereafter.

ARTICLE V.

MEETINGS.

SECTION 1. The Annual Meeting of the Academy shall be held on the first Monday in January; but if that day is a legal holiday, then upon the succeeding Tuesday. Stated meetings shall be held on the first and third Mondays of each month. Field meetings and excursions may be held at such times and places as the Academy may direct. The date of the annual election and meeting shall be advertised for two weeks in a daily paper published in San Francisco. The Council shall meet at least once a month, and whenever the President shall call it together.

SEC. 2. Any annual or stated meeting may be adjourned from time to time for unfinished business only, but not beyond the time of the next stated meeting.

SEC. 3. A special meeting of the Academy may be called at any time by

the President, notice of which shall be given by advertising in a daily paper published in San Francisco, and be posted in the hall of the Academy. No business shall be transacted at a special meeting except that specified in the call.

ARTICLE VI.

FEES AND DUES.

SECTION 1. Resident members shall pay five dollars as an initiation fee, and three dollars per quarter in advance. The payment of the quarterly dues of the officers shall be left optional with them.

SEC. 2. Life members shall pay the sum of one hundred dollars in full of all dues and initiation fee.

SEC. 3. Any member who shall be in arrears for dues more than six months, shall take no part in the business of the Academy; and the names of those who shall be one year in arrears shall be presented to the Council by the Treasurer. If the dues of any member who is delinquent for one year shall not be paid within three months after the presentation of his name to the Council, his name shall be stricken from the rolls. A person thus dismissed cannot be again proposed for membership until arrearages have been paid, nor until the expiration of one year from the date of dismissal. A person who shall have been so dismissed a second time shall never again be eligible for membership.

SEC. 4. Members who may remove more than one hundred and fifty miles from San Francisco for one year or more, may continue their membership by the payment of half dues.

SEC. 5. The Council shall be empowered to exempt (*sub silentio*) a member from dues, when, from peculiar circumstances, they may deem it for the interest of the Academy.

SEC. 6. Any member who shall have paid his dues continuously for twenty-five years, shall thereupon become a life member without the payment of further dues.

ARTICLE VII.

SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SECTION 1. Communications on scientific subjects shall be read at stated meetings of the Academy; and papers by any member may be read by the author or by any other member. If any paper is accepted for publication, the author shall be entitled to fifty printed copies.

SEC. 2. By a vote of the members present, any member of the Academy may read a paper from a person who is not a member. He shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper. Persons who are not members may read papers upon invitation of the Academy.

SEC. 3. The Committee on Publication shall direct the publications of the Academy under the general supervision of the Council.

SEC. 4. Each member shall be entitled to receive, free of cost, one copy of all publications issued by the Academy during the time of his membership.

SEC. 5. Medals and prizes may be established, and the means of bestowing them accepted by the Academy upon the recommendation of the Council, by

whom all necessary arrangements for their establishment and award shall be made. Bequests and trusts having for their object the advancement of science may be accepted by the Academy.

ARTICLE VIII.

AMENDMENTS AND BY-LAWS.

SECTION 1. This Constitution may be amended on the day of any annual election of the Academy. The proposed amendment shall be submitted in writing at a stated meeting, and, if accepted by a majority of the members then present, shall be referred to the Council, who shall have power to amend the proposition, and shall report the same, as amended by them, to the Academy. The report of the Council, or if no report be made by that body within one month after its reference to them, the original proposition, shall be considered by the Academy at a stated meeting, and may be amended at such meeting. If at this meeting the proposition be adopted by a majority of the members then present, it shall be conspicuously posted in the hall of the Academy from the time of such adoption until the day of the annual election, when it shall be voted upon by ballot, in the same manner as the officers of the Academy. No proposed amendment shall be voted upon on the day of the annual election, unless it has been finally adopted at a stated meeting, and posted in the hall of the Academy at least two months before such annual election.

SEC. 2. The Academy shall have the power to adopt By-Laws, not inconsistent with this Constitution, for the conduct of its meetings, the government of its officers, and management of its affairs. Such By-Laws may be adopted or amended, at any stated meeting, by a two-thirds vote, provided the proposition for such By-Laws or amendment shall have been presented at a previous stated meeting, and posted in a conspicuous place in the hall of the Academy for not less than two weeks; but no by-law or amendment can be voted upon during the month preceding the annual election.

SEC. 3. Nothing in this Constitution or the By-Laws thereunder shall affect the *status* of the present Officers and Trustees of the Academy for the term for which they have been elected, nor until their successors have been elected and qualified hereunder.

The following are the By-Laws, as reported from the Trustees for adoption:

ARTICLE I.

MEETINGS.

SECTION 1. The Stated and Annual Meetings of the Academy shall be held at the hall of the Academy, and the hours of meeting shall be as follows: From the 1st of September to the 1st of May, at half past seven in the evening; and during the remainder of the year, at eight o'clock.

SEC. 2. In the absence of any officer, a member shall be chosen to perform his duties temporarily, by a plurality of *viva voce* votes, upon nomination.

ARTICLE II.

RULES OF ORDER.

SECTION 1. The parliamentary rules, as adopted and practiced in deliberative bodies in the United States, shall be the rules of order in the transaction of business of this Academy, except so far as these are modified by the Constitution of this Academy.

ARTICLE III.

ORDER OF BUSINESS.

1. Reading of the Minutes of the previous meeting.
2. Election and reception of new members.
3. Propositions for membership.
4. Donations to the cabinet.
5. Donations to the library.
6. Written communications.
7. Verbal communications.
8. Reports of Standing Committees.
9. Reports of Special Committees.
10. Unfinished business.
11. Reports of officers.
12. New business.
13. Adjournment.

ARTICLE IV.

MEMOIRS.

SECTION 1. The Secretary shall receive memoirs at any time, and report the date of their reception at the next stated meeting; but no memoir shall be published unless it has been read before the Academy.

SEC. 2. Memoirs shall date in the records of the Academy from the date of their presentation to the Academy, and the order of their presentation shall be that in which they were registered, unless changed by consent of the author.

SEC. 3. Papers from persons not members, read before the Academy, and intended for publication, shall be referred to the Council at the meeting at which they are read. The Council shall report thereon to the Academy no later than the second stated meeting from date of reference.

SEC. 4. All discussion upon the claims and qualifications of nominees, before the Council, shall be held strictly confidential, and remarks and criticisms then made shall not be communicated to any person who was not a member of the Academy at the time of discussion.

ARTICLE V.

COMPLAINTS AND TRIAL.

SECTION 1. Any complaint against a member, or any charge for which his expulsion is demanded, shall be in writing, signed by the member making the charge, and presented to the Council.

If the Council shall deem the matter worthy of investigation, they shall furnish the accused with a copy of the charge, together with a notice that the same will be presented to the Academy for investigation.

The notice shall specify the time at which the charge will be presented to the Academy, and, together with the copy of the charge, shall be served upon the accused at least one week before the time therein specified for presentation.

At the stated meeting specified in the notice, the Council shall present the matter to the Academy, and thereupon the Academy shall fix a time for the trial, which time shall be either at a stated meeting or at an adjourned stated meeting.

The accused shall have the privilege of appearing at the trial with counsel, and of offering witnesses in his behalf; but shall not be present at the discussion or vote of the Academy upon the matter.

Hereupon, upon motion, and after considerable discussion, the Academy, with only one dissenting voice, adopted the amendments as reported from the Board of Trustees, as and for the Constitution and By-Laws of the Academy, in place of those heretofore existing.

On motion, it was ordered that the Constitution be printed at once, and copies of the same be placed in the hands of members for examination with reference to amendments.

Regular Meeting, August 17th, 1874.

President in the Chair.

Fifty-one members present.

Donations to the Museum: Prof. Herst donated specimen of burrowing Mollusca, genus *Zirphæa*, probably *Zirphæa crispata*, found at Victoria; also, from same, a small Fish from the north. An eel-shaped Fish, (*Ophisurus Californiensis*) described and figured in Proceedings of this Society, in September, 1863, by Andrew Garrett; the specimen then noticed was said to have been captured at Margarita Bay; this is from Magdalena Bay, commonly known among the whalemen as Margarita Bay. Specimen of a double-headed Snake, the tail being similar to the head; it is per-

fectly harmless; collected by Rev. S. V. Blakeslee in the Sierras; it is labeled as *Wenona plumbea* (?) but there is some doubt as to the species. A small Collection of Plants from the Island of Strick, collected by J. C. Werner and presented by W. G. W. Harford; also a piece of Camphor Wood from the wreck of a Japanese junk on the Island of Strick. Kelp used as food by Japanese fishermen of the Island of Strick. Mr. F. P. McLean presented a spherical mass of hard Sandstone found near Saucelito. Dr. Behr presented a Chicken with four legs and four wings. James Behrens presented two specimens of *Estheria Californica*, Packard, a very curious entomostraceous crustacean from Alameda County, Cal. Dr. Blake presented a day-flying Moth. Charles G. Yale presented a branch of *Torreya Californica*, or "California Nutmeg," collected in Santa Cruz mountains from the top of a tree over 100 feet high. Like the so-called "wild coffee," this "California Nutmeg" has no affinity, either in structure or scientific position or qualities, with the plants which the popular name implies. J. W. A. Wright presented a specimen of a Fern, (*Woodwardia radicans*) peculiar on account of its great size. A specimen of the so-called "Wild Coffee Plant" was presented. Mr. Bloomer pronounced it *Frangula Californica*, belonging to the order *Rhamnaceæ*, mostly trees and shrubs, with simple *alternate* leaves. *Coffea arabica* belongs to the order *Cinchonaceæ*, a well marked and large family, containing a very considerable number of important species.

R. E. C. Stearns presented specimens of "Chinese Water Nuts" of the genus *Trapa*. Mr. Stearns said that the Chinese water nuts presented were not uncommon in this city, as he had seen perhaps as many as a bushel in a single lot. They are the fruit or nut of an aquatic plant which grows in lakes and streams, and the species before us is cultivated by the Chinese, and has an extensive sale in that country, being highly esteemed. There are several species of this water nut, and the plant is known to botanists as *Trapa* and are *dicotyledonous* plants, belonging to the natural order *Onagraceæ*. The specimens shown are the fruit of the *Trapa bicornis*, (or two-horned) the propriety of the name being seen at a glance. The nut is sometimes called the water chestnut. The Chinese call

them *Ling* or *Links*. Another species, *Trapa natans*, grows in middle and southern Europe, middle Asia, and northern and central Africa, and the fruit or nut has four spines. *Trapa bispinosa* is found in Asia and parts of Africa, and it is said also to be cultivated in Japan. In some of these countries this latter species is an important staple in the way of food to the population. The nuts are held in high estimation by the Hindoos, and are sold in all the shops in India. Quite likely some one of these species might thrive well in this country, and it would be well for some enterprising Californian to experiment with the Chinese species, the seeds of which are easily obtainable in this city.

Donations to the Library: In addition to the usual periodicals and exchanges the Library received: Annual Reports of the Chief Signal Officer to the Secretary of War, for years 1872 and 1873. Weekly Weather Chronicle. Daily Bulletin, synopses, probabilities, and facts of the month of June, 1874. Daily Bulletin of weather reports, Signal Service U. S. A., taken at Washington, with the synopses, probabilities, and facts for September, 1872; all four of these were presented by H. W. Howgate, U. S. A. Dr. M. Linderman Brenan presented the second part of the Report of the last German Polar Expedition. Albert J. Mayer, Chief Signal Officer, U. S. A., presented circular upon the "Practical Use of Meteorological Reports and Weather Maps." Ross' Voyage of Discovery to Baffin's Bay. This book is interesting, as having been found with others, on the 12th of April, 1873, on Ocean Island, North Pacific, remaining from the wreck of the U. S. S. Saginaw, by J. C. Werner, presented by W. G. W. Harford.

On the Structure of the Sonorous Sand from Kauai.

BY JAMES BLAKE.

In order to ascertain, if possible, the cause of the sound that is produced by the sand from Kauai, presented to the Academy at a former meeting, I investigated its structure under the microscope, and I think the facts I have ascertained fully explain the manner in which the sound is produced. As the grains of sand, although small, are quite opaque, it was necessary to prepare them so that they should be sufficiently transparent to render their structure visible. This was effected by fastening them to a glass slide and grinding them down until one flat surface was obtained. This surface was then attached to another slide, and the original slide being removed, the sand was again ground down until sufficiently transparent. The grains were found to be chiefly composed of small portions of coral and apparently calcareous sponges, and presented under the microscope a most interesting object. They were all more or less perforated with small holes, in some instances forming tubes, but mostly terminating in blind cavities, which were frequently enlarged in the interior of the

grains, communicating with the surface by a small opening. A few foramineferæ were also met with, and two or three specimens of what appeared to be a minute bivalve shell. Besides these elements, evidently derived from living beings, the sand contained small black particles, which the microscope showed to be formed principally of crystals of augite, nepheline, and magnetic oxide of iron, imbedded in a glassy matrix. These were undoubtedly volcanic sands.

I have shown some of the principal forms, as seen under the microscope, but such is the beauty and delicacy of their structure that it would be impossible to give anything more than a general idea of it, except with far more elaborate drawing than I am artist enough to make. The structure of these grains fully, I think, explains the reason why sound is emitted when they are set in motion. The friction against each other causes vibrations in their substance, and, consequently, in the sides of the cavities they contain, and these vibrations being communicated to the air in the cavities, under the most favorable conditions for producing sound, the result is the loud noise which is caused when any large mass of sand is set in motion. We have, in fact, millions upon millions of resonant cavities, each giving out sound which may well swell up to resemble a peal of thunder, with which it has been compared; and the comparison—I know from others who have heard it—is not exaggerated. The effect of rain in preventing the sound is owing to the cavities in the sand becoming filled with water, and thus rendered incapable of originating vibrations. The chemical compositions of the sand, with the exception of the volcanic grains, is calcareous, being completely dissolved by chlorhydric acid, although I think it probable that some of the speculæ in the sponges are silicious.

Canals depending on Tide Water for a Supply, or the Supply of Tidal Water to Canals.

BY THOMAS GUERIN, CIVIL ENGINEER.

My attention was first drawn to this question by a survey I have made of a proposed canal which was intended to connect the waters of the Bay of Fundy with those of the Gulf of St. Lawrence. On studying the map of North America, you will perceive that the province of Nova Scotia is connected with the main land by a narrow isthmus called the Isthmus of Chignecto, some eighteen miles across.

Vessels bound from Canada to the United States have to sail round Nova Scotia, thus increasing the sailing distance about 800 miles, which would be obviated if a canal were constructed across the isthmus.

I found during the progress of the survey that there was little or no water on the isthmus which could be made available for feeding the canal, so that the tides of the Bay of Fundy had to be relied upon for the necessary supply.

In questions of this kind it is necessary that the high and low water surfaces of the canal, as well as the level of its bottom, must be at such elevations and its dimensions must be of such magnitude as to enable the tide to fill it to the required level within a reasonable time. It will be necessary to empty the canal occasionally for the purposes of cleaning and repairing; and there must

be means at hand to fill it soon again, and maintain its surface at the required level for the purposes for which it is intended.

To know the time the tide will take to fill a canal, then, is one of the great questions which enter into the discussion of this subject.

The time required to fill a canal or reservoir by tide water to a given height, or the quantity poured into it by the tide in a given time, must depend on the elevation of its bottom, and on the velocity with which the tide flows into it. The science of hydraulics in its present state, so far as I know it, does not afford the required assistance in this emergency—new principles must therefore be investigated. I propose to do this, and I submit the investigation for your discussion.

No comparison can be made between the velocity of the tide at sea and its velocity flowing up the bed of a river or through a canal, for the following reasons: The velocity of the tidal wave in the Atlantic Ocean is stated to be about 700 miles an hour, and yet the depth of the moving tide is insignificant; the tidal wave being only two and a half to three feet high.

The general direction of the tidal wave at sea is from east to west; and yet on land it is seen in various places to move up the beds of rivers from west to east. The Gulf of St. Lawrence and Bay of Fundy are on the east and west side of the Isthmus of Chignecto, through which the proposed canal had to pass; they are only some eighteen miles apart at this locality, and yet the tide runs to the east up the beds of streams emptying into the Bay of Fundy, while it runs to the west from the Gulf of St. Lawrence up the beds of streams emptying into the latter.

It is true that high water is earlier at the east side of this isthmus by about two hours and thirty minutes than at the west wide; but it takes about six hours to rise, and hence, during the remaining three hours and thirty minutes the tide is running in opposite directions.

From these facts it would be erroneous to suppose that the velocity of the tide at sea is a function of the velocity with which it moves up the bed of a river. The inland velocity of the tide must therefore depend upon the head or height to which the waters are piled on the adjacent lands which obstruct it in its course from the sea, and hence the vertical and horizontal velocities of the tide must be coördinates of one another.

Let r = the height to which the tide rises in the time, t^{sec}.

Let v = mean horizontal velocity during the same time.

Then we get

vt = horizontal distance advanced.

$\frac{r}{vt}$ = the tangent of the inclination of the thread of the current thus generated.

This inclination varies as the square of the velocity, the section and wetted perimeter being constant, unless the velocity is exceedingly small.

Now, in the present case, it is the velocity of the advancing fillet we are in search of—its wetted perimeter and section do not vary while moving in the

same bed; hence, $\frac{r}{vt}$ varies as v^2; and if t is constant, or equal to one hour, r varies as v^3 or v varies as $r^{1/3}$; and hence $v = nr^{1/3}$ where n is a coefficient, which I have determined in the following manner:

There is the bed of a small stream or river in the vicinity of the proposed canal. At a distance of about one and a half miles from the shore I caused a length of 4,148 feet to be measured along the bank of this river, and further on, another distance of 13,040 feet in the same direction. I caused the flowing tide to be watched, and the time to be noted during which the advancing fillet was traversing those latter two distances: the time occupied in moving over 4,148 feet was twenty-five minutes, and over the other distance one hour and twenty minutes, thus giving a velocity in the former case of $2\frac{76}{100}$ feet per second, and in the latter of $2\frac{717}{1000}$ feet. I caused the height to which the tide had risen during those times to be noted by means of gauges: in the first case it amounted to $3\frac{87}{100}$ feet; in the second case it amounted to $11\frac{30}{100}$ feet; thus, r in the one case is nearly $9\frac{80}{100}$, and in the other about $8\frac{50}{100}$. The cube roots of these numbers are nearly in the ratio of $2\frac{76}{100}$ to $2\frac{717}{1000}$, a fact which goes to corroborate the theory just established; hence.

$$\frac{2.717}{(8.50)^{1/3}} = n = 1.3313.$$

This is an important coefficient, and worthy the attention of engineers who may be engaged in similar duties. It is to be hoped that some gentleman will try its correctness in some other locality, so as to verify it, or amend it if necessary.

It may, perhaps, be objected that the value of n, thus obtained, from the movement of the tide up the bed of a river or inclined plane, will be inapplicable in determining the velocity while moving along the bed of a horizontal canal.

Let A B represent the bed of the canal, A C that of the river; suppose A D the velocity of the tide while moving along A B, D T being drawn perpendicular. It is plain that A T will represent its velocity in ascending A C, that is to say: if radius represent the velocity in the horizontal direction, the cosine of the inclination will represent the velocity up an incline.

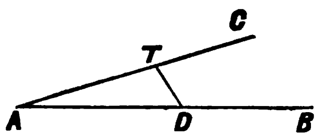

Fig. 1.

The tangent of the inclination of the bed of the river on which I have experimented was found to be .00076; this angle is so small that the cosine may be considered equal to radius; hence, there can be no difference between the velocity of the tide moving up the bed of this river, and that of the same tide moving in a horizontal canal. Indeed, I may assert generally that the inclinations of rivers flowing into the sea are so small that the velocity of the tide flowing up their beds is the same as it would be on a horizontal plane.

Having now ascertained the means by which to obtain the horizontal velocity

of the tide, from having its rate of rise, let us next turn to the subject of filling a canal or reservoir from tide water.

Let G A M T be the summit reach of a canal, and A G the lock-gate at the entrance, through which the tide water is admitted; J P being the level of the ebb or low tide, and T G that of flood or high tide.

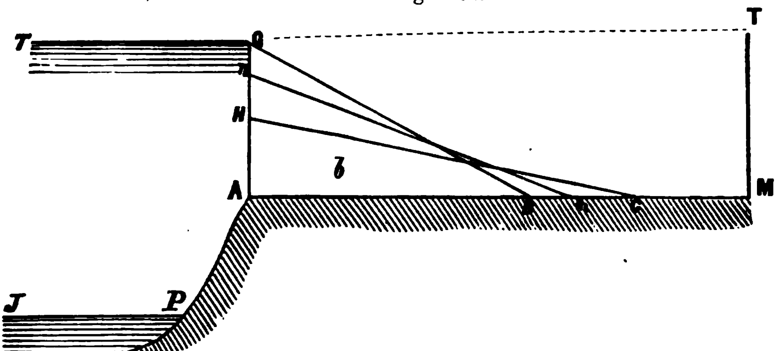

FIG. 2.

Let us suppose that while the tide was rising the distance A G, it had advanced in the canal the distance A B; then the surface of the water in the canal at the end of the first tide will be indicated by the line G B.

While the tide is at the level T G, the gate A G is closed, and the water in the canal will commence to descend from G and advance beyond B. Let us suppose that during a given time it has fallen the distance G H, and advanced the distance B C: then the line G B will conform to H C.

Let $x =$ G H, and $y =$ B C.

$t^{sec.} =$ time of falling x, or $=$ time of advancing distance y.

$v =$ horizontal velocity of tide at the point B; this can be ascertained by the coefficient already found.

Let $a =$ A G $=$ the distance the tide has risen, from the moment it commences to enter the canal until it reaches flood or high tide.

$b =$ A B $=$ horizontal distance advanced in the same time.

Let G n $= dx$, and B m $= dy$.

Let $r =$ mean velocity with which x is described, and $z =$ mean velocity in describing y.

Now, because the velocity of a current is as the square root of its inclination,

$$\sqrt{\frac{a}{b}} : \sqrt{\frac{a-dx}{b+dy}} :: v : v\sqrt{\frac{a-dx}{b+dy} \times \frac{b}{a}} = \text{velocity at m.}$$

This may be considered the velocity with which dy is described, and multiplying by dt we get $dt\, v \sqrt{\frac{a-dx}{b+dy} \times \frac{b}{a}} = dy = zdt.$

$$\therefore v \sqrt{\frac{a-dx}{b+dy} \times \frac{b}{a}} = z, \text{ and } tv \sqrt{\frac{a-dx}{b+dy} \times \frac{b}{a}} = tz = y.$$

$abt^2 v^2 - bt^2 v^2\, r\,dr = aby^2 + ay^2\, dy$. Substitute for dx, and there results

$$abt^2 v^2 - bt^2 v^2\, r\,dt = aby^2 + ay^2\, dy.$$ Integrate, and we get

$$abt^2 v^2 - b\, v^2\, r\, \frac{t^3}{3} = aby^2 + \frac{ay^3}{3} = abt^2 z^2 + at^2 z^2\, \frac{y}{3}$$

$$abv^2 - bv^2\, \frac{x}{3} = abz^2 + az^2\, \frac{y}{3}$$

$$z = v\sqrt{\frac{b}{a}\left(\frac{a - \frac{1}{3}x}{b + 3\,y}\right)}$$

Hence, $tv\sqrt{\frac{b}{a}\left(\frac{a - \frac{1}{3}x}{b + \frac{1}{3}y}\right)} = y$ ....No 1°.

Again: let MJEG represent a cross section of the canal.

w = width at bottom.

a = depth as before.

n = ratio of slopes of banks.

Then the quantity of water received by the summit reach from one tide, whose longitudinal section is AGB and cross section MJEG, will be

$$\left(\frac{w}{2} + \frac{an}{3}\right) \times ab$$

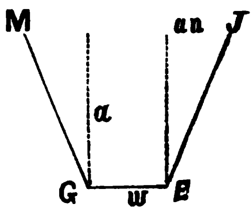

FIG. 3.

When G has descended to H; then a becomes $a - x$, and b becomes $b + y$, and hence

$$\left(\frac{w}{2} + \frac{an}{3}\right) \times ab = \left(\frac{w}{2} + \frac{(a-x)\;n}{3}\right) \times \left(a - x\right) \times \left(b + y\right) \ldots \text{No } 2^\circ.$$

From these two equations, when any one of the quantities x, y, t, is given, the other two can be found.

Considering the movement of the tide within the summit reach of the canal, it is manifest that when the reach is long as in the instance I have referred to, the quantity of water poured into it by one tide cannot have come to a level before the next succeeding tide commences to enter the canal. Let us suppose that H (fig. 2) is the point at which this succeeding tide begins to enter: then the time occupied by the tide in flowing into the canal is limited to the time the tide takes to rise from H to G.

Let g = entire rise of tide, = JT, or difference of level between high and low tide.

c = mean vertical velocity of tide.

Then $\frac{2\,g - x}{c}$ = the time that has elapsed from previous high tide until water commences again to enter the canal = $t^{sec.}$

Equation No 1° now becomes

$$\frac{2\,g - x}{c} \times v\sqrt{\frac{b}{a}\left(\frac{a - \frac{1}{3}x}{b + \frac{1}{3}y}\right)} = y \ldots\ldots\ldots\ldots \text{No } 1^\circ_a$$

From Equations No 1°_a and No 2° we can obtain x and y, and we are thus enabled to ascertain the elevation at which every tide commences to enter the

summit reach of the canal; also, the distance each tide has advanced; also, the distance fallen from G towards A before the next succeeding tide commences to enter, etc., etc.

It must be borne in mind that w represents the width of opening of the canal, at the level always at the point H. It is only on the entrance of the first tide that w will represent the width of the bottom of the canal. Similarly, a will represent the distance A G only at the first tide; it will represent H G afterwards.

A canal through the Isthmus of Chignecto, connecting the waters of the Bay of Fundy with those of the Gulf of St. Lawrence, is considered in Canada of great importance to the trade between that country and the Atlantic States of the Union. So the Canadian Government have employed different engineers to report on the best plan.

One plan was adopted at an estimated cost of upwards of six millions, and an order was issued by the Government to call for tenders for the construction of the work; but it was shown by the formula which I have here investigated that it would occupy over four months to fill the canal to the required level if built according to this plan.

Another plan which would cost over seven millions was about to be adopted. The latter plan recommended the construction of reservoirs, so as to store the tide water, and thus assist in filling the canal, and maintaining its water surface at the required level for navigation; but those formulæ have shown that according to this plan, the canal, if filled to the required level, would become unnavigable before one month, owing to the inability of the reservoirs to maintain a sufficient supply.

Professor George Davidson read an exhaustive paper " On the coming transit of Venus," illustrating his remarks with diagrams, etc.

Mr. Stearns made the following remarks on the death of Dr. Ferdinand Stoliczka:

Mr. President: I regret that I have to announce to the Academy the death of a corresponding member of high scientific reputation and distinguished ability, Dr. Ferdinand Stoliczka, of Calcutta, palæontologist, connected for many years and up to the time of his death with the Geological Survey of India; also Secretary of the Asiatic Society of Bengal, and corresponding member of many scientific societies in Europe and America, and of the California Academy of Sciences since December 18th, 1865.

Dr. Stoliczka was born in Moravia in May, 1838, and died on the nineteenth day of June, at Shayrock, between the Karakorum Pass and Lah in Ladak, while on his return from an exploration amid the mountainous regions of the interior of Central Asia.

He commenced his scientific labors when quite a young man, having joined, soon after finishing his University course, the Imperial Geological Institute of Austria, where he soon displayed great ability as a palæontologist, and by his investigations among the recent and fossil Bryozoa. He joined the British Indian Geological Survey corps in 1862,and worked hard and well in this service, both in the field and the closet, as the publications of the Survey and his many papers in the proceedings of various scientific societies attest.

Dr. Stoliczka's researches were not restricted to the testimony of the rocks, as shown in the numerous fossils described by him; for besides his geological memoirs, his numerous papers on the Natural History of India, including all divisions of animal life, from the higher mammals to the Actinozoa, display his varied knowledge and breadth of study.

His prepossessing appearance, amiable and excellent character, and high culture, gave him a *personnel* altogether attractive, and he was much beloved and esteemed by all who enjoyed the honor of his acquaintance. He died while in the prime of life, in the midst of his scientific labors, not full of years, but nevertheless full of honors.

Regular Meeting, September 7th, 1874.

Vice President in the Chair.

Thirty-five members present.

On ballot, the following gentlemen were duly elected: B. F. Sherwood, life member; Charles Wolcott Brooks, James A. Waymire, Frank P. McLean, Abel T. Winn, Fred. T. Newberry, Chas. Sonntag, Charles M. Blake, Dr. R. B. Swan, resident members.

Donations to the Museum: A collection of Shells from Tahiti, embracing 338 specimens, presented by Captain M. Turner; specimens of the Porcupine Fish, from the Society Islands, also presented by Captain Turner; curious deposits from a mineral spring in Lower California, received from David Turner, United States Consul at La Paz; a deep-sea Crab, of enormous size, from the office of the United States Coast Survey; jar of alcoholic specimens of Fish, from Captain Lawson, of the Coast Survey; species of Eel, from Captain Scammon; two aquatic Birds, mounted, from E. F. Lorquin; specimens of Crustacea, from Mr. Burling; curious Larva Cases, collected in a creek at Saucelito, from John H. Turney.

Donations to the Library: Transactions of the New Zealand Institute, Vol. 6, 1873; Quarterly Journal of the Geological Society, No. 119, August, 1874; Overland Monthly, August, 1874; Popular Science Monthly, August, 1874; Seventh Annual Report of Trustees of Peabody Museum; California Horticulturist, 1874; La Naturaleza Periodico Cientifico, No. 42; Journal of Botany, August, 1874; Astronomical Register, August, 1874.

Pacific Coast Lepidoptera, No. 7.—Descriptions of some New Species of Heterocera.

BY HENRY EDWARDS.

Fam. EPIALIDÆ. H. S.

Epialus Tacomæ. Hy. Edw. n. sp.

Head, thorax, abdomen, and wings wholly reddish-brown, darkest upon the thorax and along the costa.

Primaries, with a double oblique row of white spots, narrowly edged with black, forming two interrupted bands. The basal one is the shortest, and is composed of oblong spots divided by the nervures. The outer reaches from the median nerve to the interior angle, where it is broadest. There is a faint white dot between these rows of spots, and traces of some dull yellow blotches toward the apex.

Secondaries, slightly transparent, with the fringes and costal margin brighter than the disc of the wing.

Underside, with the rows of white spots only faintly visible. The costal margin of the primaries is marked with dull yellow blotches, and the whole of the fringes bright reddish-brown.

Exp. of wing, 1.60 inch.

Length of body, 0.65 inch.

Taken at Tacoma, Washington Territory, by Mr. Jas. Behrens. Coll. Hy. Edw.

Nearly allied to *Ep. Mathewi*, Hy. Edw., but the markings more closely resemble those of the European *H. sylvinus.*

Fam. ARCHIDÆ. B.

Halesidota Davisii. Hy. Edw. n. sp.

Head, collar, and patagia cream yellow, the latter fringed internally with grayish-blue, forming a double line upon the thorax. Thorax and abdomen dark buff, the latter deepest posteriorly, white at the sides, with five oblong black spots. Anal segment brown.

Primaries, semi-transparent, cream-color, with a series of five orange blotches along the costa, oblong in shape, edged narrowly with black, and divided by the subcostal nervure. The two nearest the base are connected interiorly by some

lines of black, arranged triangularly, the side of the triangle joining the two orange spots, and the apex directed towards the base of the wing. The third spot is small, almost square, and divided by a black line. The fourth is the largest, oblong, joining a bent orange line, which rests on a small triangular mark, behind which is a straight and rather narrow orange patch. The fifth spot is the smallest, almost triangular in form, with a small ovate patch beneath it. The whole of these orange spots are narrowly edged with black. On the disc is a small ring, formed by a black line, and two others, nearly the same shape, on the interior margin. Posterior margin edged with pale buff, most broadly towards the apex. This mark is enclosed in a narrow black line.

Secondaries, very pale buff, hyaline, slightly opalescent. Hairs of the anal angle, deep buff. Fringes of both wings, cream-color.

Antennæ, chestnut. Palpi, deep buff, with the terminal article black. Feet and legs buff, banded with black. Under side of the abdomen. pale cream-color. The markings of the upper side of the wings are seen very clearly beneath.

Exp. of wings, 2.20 inch.

Length of body, 0.85 inch.

Prescott, Arizona. Dr. Davis, U. S. A., to whom I have great pleasure in dedicating this delicate species.

Fam. NOTODONTIDÆ. B.

Heterocampa (?) *conspecta*. Hy. Edw. n. sp.

Head very small, iron-gray. Thorax cinereous, with a waved brown streak in front. Patagia also edged internally with brown. Abdomen long, extending a considerable distance beyond the wings, stone-drab, with a brown shade at the base, and with short, distinct tufts of darker hairs from the sides of the third, fourth, and fifth segments.

Primaries, cinereous at their base, with a slight purplish-red tint, and a brown basal streak, edged interiorly with black. On the disc is a black, semi-lunate streak; behind this, a patch of silver-gray, extending along the costa to the apex, and there enclosing a double black dash. The posterior margin is broadly buff towards the apex, with some black and brown dashes irregularly placed. The buff patch, (which is somewhat similar in form to that of the European *Pygæra bucephala*) shades into brown on the interior angle, and is enclosed by a black line, notched exteriorly, straight for the greatest portion of its length, but bent inwardly on the costa, and not quite reaching the interior margin. which has a narrow streak of pale fawn-color running its whole length. Fringes, fawn-color, intersected with brown. Secondaries, pale drab, with a brownish shade near the costa and the anal angle, and a faint brown medium band. Fringe, whitish.

Antennæ, chestnut-brown, not pectinate to the tip. Palpi, very short, blackish-gray. Tibiæ densely clothed with hairs. Tarsi, rather long and slender.

Under side. Primaries dirty white, with blackish median cloud, widest on the

costa, and extending to the base; some dashes of same color on the margins. Secondaries, whitish, glossy; costa and anal angle with blackish patches.

Exp. of wings, 1.35 inch.

Length of body, 0.80 inch.

Napa County, Cal. June. Taken at light.

I have placed this beautiful insect provisionally in *Heterocampa*, at the suggestion of my friend, Mr. Stretch; though it may prove to be the type of a new genus.

NOTE.—I wish to correct an error into which I have been unintentionally led in No. 4 of these papers (Proc. Cal. Acad. Sci., Feb., 1874). I have therein described, as a new species, *Spilosoma pteridis*. Closer investigation by Mr. Stretch and myself convinces us that we have to deal with the second species of *Antarctia*, noticed by Boisduval; but as Mr. Stretch had previously arrived at the conclusion that *A. vagans*, Bdv., *A. rufula*, Bdv., and *A. punctata*, Pack., were all one species, and referred only to varieties of our common Californian form, I was led to believe that my species from Vancouver Island was undescribed. It is now, however, established beyond a doubt, both from a careful examination of the caterpillar and the perfect insect, that we have two distinct species of *Antarctia* already known from our Coast, which have been described by Dr. Boisduval as *Ant. vagans*, and *Ant. rufula*, and that my *Spilos. pteridis* belongs to the former species. The synonomy will therefore stand thus:

1. *Antarctia vagans*, Bois., Northern California.
   Spilosoma pteridis, Hy. Edw., Vancouver Island.
2. *Antarctia rufula*, Bois.
   Antarctia punctata, Packard, San Francisco district.

I trust that the description of the caterpillar and chrysalis, which I have appended to my notice of *Spilosoma pteridis*, will be sufficient apology for my having unwittingly encumbered the synonomy of the genus.

Pacific Coast Lepidoptera, No. 8.—On the Transformations of some species of Heterocera, not previously described.

BY HENRY EDWARDS.

Fam. ZYGŒNIDÆ.

Phrygahidea Californica. Packard.

Egg. Spherical, a little flattened above, shining, yellowish white at exclusion—attached in clusters of about ten or twelve to the upper side of the leaves. The third day the apex of the egg assumes a dull orange hue, afterwards changing to a bright reddish purple, and gradually to a duller shade as the young larva emerge. The eggs were laid by a ♀ in my possession, on July 5th. All (about twenty-five specimens) emerged almost simultaneously.

Young larva. Head very large, almost monstrous, pale olive brown, with narrow black line at the base. Body pale canary yellow, with four rows of black spots arranged longitudinally in lines.

The mature form of the larva is noticed in Stretch's "Zygœnidæ and Bombycidæ of North America," but I subjoin the description of one of the many varieties to which it is subject, believing that all information with reference to this species (the position of which in classification has not yet been settled by entomologists) will prove to be of value:

Yellowish-white, shining, head large, round, stone color, with black point on each side of the mouth, a median stripe of reddish brown, and a narrow one of same color on each side. A broad black stripe extends laterally across the second segment at base of the head, and another across the thirteenth segment, which also contains a broken black dorsal line. In the middle of the black lateral stripes is a waved whitish line, enclosing a narrow black one. At the base of the abdominal legs is a waved interrupted yellow line, edged narrowly with black.

Under side yellowish-white, faintly marked with broken brown waved lines; feet pinkish, striped with black; abdominal legs, yellowish-white.

Fam. BOMBYCIDÆ.

Clisiocampa constricta. Stretch. n. sp.

Head, slate-gray, with black spots; mouth parts, black, tipped with dull yellow. Body, slate-gray, covered laterally with black irrorations. Along the middle of the dorsal region is an irregular black stripe, marked on its sides with waved orange lines, and surmounted at the union of the segments by a double tuft of chestnut-brown hairs. On the second and third segment, in the middle of the notched black line, is a stripe of dull white. From the base of the orange brown-tufts spring a few scattered black hairs, longest anteriorly, and from the forepart of each segment arise lateral tufts of white hairs. The stigmata are orange, with black central points. Above the base of the feet is a black interrupted line, out of which spring other white hairs, irregularly disposed. Under side, dull, velvety black, with the anterior portion of each segment whitish. Feet and prolegs black, yellow at their tips. Length, 1.85 inch. Food plant, *Quercus Sonomensis.* Benth.

The larva is frequently attacked by a species of *Ichneumon*, the eggs of which are visible on the head and anterior segments.

Chrysalis. Chestnut-brown, with few hairs along the base of each segment.

Cocoon. Ovo-lanceolate, very silky, yellowish-white, with some portions glued in compact mass, and whiter than the remainder. Chrysalis only imperfectly seen through the web.

Larva, May 22d; changed to chrysalis, May 29th. Imago, June 16th.

Leucarctia acrea. Drury.

Young larva, previous to last moult. Black, with yellow patches, irregular in form, along the sides and at the base of the segments, each of which is provided with seven flesh-colored tubercles, from which spring whitish or stone-colored hairs, sparsely intermingled with black. The hairs of the

dorsal region are nearly white. Head, black, shining, with broad yellow stripe in center. Feet, black; abdominal legs, flesh-color, banded with black.

Halesidota sobrina. Stretch.

Larva. Head, rough, deep dull black. Body, velvety black, slightly shining. In the center of each segment, from five to twelve, inclusive, is a raised triangular tuft of rich, velvety black hairs. At the base of these is a double row of tubercles, from which spring radiating spines arranged in circular form, those nearest to the center being bright lemon-yellow, while outwardly they are fawn-drab. Laterally, there is another series of double tubercles, with spines still arranged in circular form, and entirely fawn-color. From the fourth and tenth segments spring two bunches of long black hairs, directed outwardly and anteriorly, like those of the genus *Orgyia.* The yellow spines of the interior dorsal tubercles give the appearance of a rich yellow dorsal line.

Under side, dull black; feet, black; abdominal legs, yellowish, banded with black. Length, 1.70 inch.

Food plant, *Pinus insignis,* Douglas, (Monterey pine).

Larva taken at Monterey May 31st; changed to chrysalis, June 4th—9th. Imago appeared June 16th—20th.

Chrysalis. Bright chestnut-brown, palest towards the head, enclosed in thin web compósed of hairs of the larva, through which the chrysalis is indistinctly seen. The transformation is effected under bark of decaying pine trees, and beneath logs.

Halesidota argentata. Pack.

Larva. Precisely similar in size and form to that of *H. Sobrina,* but differing considerably in color. Body, bluish-black, slightly shining. Each segment, from five to twelve inclusive, is provided with tuft of velvety black hairs, as in the last species, while the fourth and tenth are armed with long bunches of black hairs, those of the tenth being decidedly shorter than in *H. Sobrina.* The stellar pencils of the sides are very dark chestnut-brown, instead of stóne color, while the yellow spines, which give so bright an appearance to that species, are here only very faintly seen. Under side, dull brown; feet and prolegs with fleshy tinge. Length, 1.70 inch.

Big trees, Calaveras County, June 19th.

Taken on bark of *Pinus ponderosa,* Dougl., (Yellow pine) and *Pinus Lambertiana,* Dougl., (Sugar pine). Crawling restlessly about, and eating little or no food after capture. In five or six days the seven specimens taken spun a thin web similar to *H. Sobrina,* but very much darker in color. The chrysalis itself is, however, paler than its ally, being in all cases the very lightest shade of chestnut. Three of my specimens were attacked by *Ichneumon.* The remainder gave 1 ♂, 3 ♀. It is a source of extreme pleasure to me to be able to prove the distinctness, as species, of *H. Sobrina* and *H. Argentata,* as the fact was one which occasioned considerable doubt to my friend, Mr. Stretch, and myself. My larvæ from Monterey gave undoubted *H. Sobrina,* agreeing in

nearly every respect with Mr. Stretch's figure and description. The only point of difference is the color of the abdomen, which is represented by Mr. Stretch as brown. Now, the only specimen known to Mr. S., which was taken by the late M. Lorquin, was very old, and the abdomen may have become greasy or stained from the ravages of time. The antennæ were, I think, also destroyed. In all other characters my specimens agree exactly with the plate and text in the "Bombycidæ of North America." As to *H. Argentata*, there can be little or no doubt. The species has long been known, and the caterpillar was found by me in the Yosemite Valley some years ago. I have also seen it on different occasions at Lake Tahoe, the Dalles, Oregon, and in Vancouver Island, though I have never succeeded in rearing it until the present instance. *H. Sobrina* would appear to be a much more rare and local species than its nearest ally.

Pyrrharctia Isabella. Packard.

Larva. Head black, with the mandibles and mouth parts generally yellowish-white. Body, entirely slaty-black. Spines, very long, arranged in spreading bunches from tubercles. Those of the four anterior segments black, the fifth, sixth, seventh, and eighth bright chestnut-brown, with a few scattered black hairs, while the remainder are black, similar to those anteriorly. Feet, dirty white. Length, 1.25 inch.

Chrysalis. Enclosed in cocoon spun from hairs of caterpillar, those of the anterior segments being so mixed with the others as to give an uniform color of dark-brown.

Changed to chrysalis, July 15th. Imago, August 11th.

Mr. Stretch has raised what appears to be this species from a larva of an "uniform grayish-brown." Does this fact not serve to indicate that *P. Isabella*, Pack., and *P. Californica*, Pack., may be distinct species after all?

Platysamia ceanothi. Behr.

Larva. Pale apple-green, of a very vivid tint throughout, with a slight whitish bloom over the whole surface. Head, with some purplish-black streaks in front and at the sides. Mouth parts, pale-green, pitchy internally. Second segment with four minute black dots, edged with white anteriorly, and two very small white mammiform tubercles on the sides. Third, fourth, and fifth segments, with long raised protuberances, pale yellow, with a black, swollen band in the middle, and each surmounted by six blackish spines. The third segment has also four lateral raised white spots. The fourth and fifth segments have two mammiform white spots, the lateral ones on these segments becoming merely black points. On the sixth segment is a faint white raised spot, in the same position as the white swollen tubercles on the preceding segments. Seventh and eighth, with only black points laterally. Ninth, tenth, and eleventh, without any trace of spots. Twelfth segment bears in the middle a long, raised protuberance, yellow, banded with black, exactly similar to those of three, four, and five. On this segment there are also two lateral points, white, tipped with black. Anal segment with four black dots arranged in a square, and two white

and black points as in twelve. Stigmata white, edged anteriorly with black. Below the stigmata, and parallel with them, is a row of very minute black dots, edged with greenish-white. Feet, yellowish-green, with the tips purplish-black. Abdominal legs, greenish-yellow, with the edges purplish-black. Viewed from behind, the anal segment is yellowish-green.

Length, 3.30 inch.

Width, anter. 0.60 inch ; post. 0.40 inch.

Food plants, *Ceonothis thyrsiflorus*, Esch. ; *Frangula Californica*, Gray ; *Rhamnus croceus*, Nutt ; *Alnus viridis*, D. C.

When about to undergo its change, the caterpillar attaches itself usually to the under side of a twig, and spins a rather coarse and very compact outer case, with which no leaves or other extraneous substances are incorporated, and within this a reddish-brown cocoon, the filaments of which are strong, rather coarse, but glossy. The cocoon and its outer case are oval, produced into a cone at the end, by which the insect escapes.

Chrysalis. Pitchy, almost black, very short, rounded in front, and much swollen about the abdominal region. Segments rough, and transversely wrinkled.

Length, 1.15 inch.

The caterpillar changes to a chrysalis in September, and the imago appears in the following May or June. This beautiful insect was once remarkably common around the Bay of San Francisco, but the march of improvement has destroyed most of its haunts, and it must now be regarded as one of our really rare species.

Gastropacha. sp.

In August, 1873, I found, in Vancouver Island, a cocoon which I did not recognize, and was surprised at finding that it produced, in April last, a beautiful insect of this genus. Mr. Stretch believes the species to be identical with the European *G. betulifolia ;* but as I am not familiar with the transformations of that species, I append the following :

Chrysalis. Black, covered with a dense woolly substance, powdered with a fine dust, and enclosed in a very soft, woolly cocoon, formed, apparently, of very fine silk, with which a few yellowish-brown hairs are intermingled. The cocoon is placed in the angle of a frond of *Pteris*, the frondlets being drawn together at the edges as a covering.

Larva. Some days after the finding of the above-mentioned chrysalis, I discovered a larva at the base of an oak tree, which spun a cocoon precisely similar to that previously described, and I therefore believe it to be the same species ; but as the perfect insect has not yet made its appearance, I give a description of the caterpillar, without further reference to its identity :

Black, very minutely spotted with white, each segment with a broad, white, transverse band, slightly triangular dorsally, with the apex of the angle directed anteriorly. The four anterior segments have a number of chestnut-colored

nearly every respect with Mr. Stretch's figure and description. red
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would appear to be a much mor ..ker cloud. Head with four ovate,
, and two in front. Second segment with

Pyrrharctia Isabella. P ..e which are some faint yellow dashes. Seg-

Larva. Head black faint brownish streaks, running longitudinally.
white. Body, entir the anal, which has four minute black dots. An inter-
bunches from tub blackish lateral line encloses the stigmata, which are bright
sixth, seventh. first and abdominal legs, dull greenish-white, with the claws blackish.
hairs, while with a black streak posteriorly.
white. T Length, 1.10 inch.

Chr When fully grown, the caterpillar draws two leaves together, and spins a stout,
ant white, silky web, similar to many *Bombycidæ*, in which to undergo its
c change. It is remarkably destructive to many garden plants, particularly to ferns, various species of *Pelargonium*, and the pepper tree (*Schinus Molle*). It is not unusual to see large plants utterly destroyed by their attacks, and the species may be regarded as one of the most troublesome pests with which the floriculturist has to deal. Changes to chrysalis in August and September, and the moth appears in about twenty days.

Chrysalis. Smooth, greenish-white. Eyes, visible pale-brown, sometimes black. Antennæ, distinctly marked, bright chestnut-brown.

Length, 0.75 inch.

LIST OF SPECIES NOTICED.

Phryganidea Californica, Pack	Egg and Larva.
Clisiocampa constricta, Stretch	Larva and Chrysalis.
Leucartia acrea, Dewey	Young Larva.
Halesidota sobrina, Stretch	Larva and Chrysalis.
" *argentata*, Pack	" " "
Pyrrharctia Isabella, "	" " "
Platysamia ceonothi, Behr	" " "
Gastropacha, sp	Chrysalis.
Chærodes ægrotata, Pack	Larva and Chrysalis.

Aboriginal Botany.

BY STEPHEN POWERS.

this paper the word, "botany" is somewhat loosely compre-
for the lack of a better. Under it are included all the
world which the aborigines use for medicine, food, tex-
tc. Among savages, of course, there is no systematic
l knowledge. Every oak, pine, and grass has its
never groups individuals together, except occasion-
words *cha, doo, popo, com, wi, back,* (tree, bush,
something of that sort. But it is not for a moment
the Indian is a superficial observer; he takes careful note of
qualities of everything that grows on the face of the earth.
scribes marvelous and impossible qualities to some plants—frequently
which do not grow in his neighborhood—but that does not blind him to
their real properties. And as his perceptions of individual differentations is nice and minute, so his nomenclature is remarkably full. I assert without hesitation that an average intelligent Indian, even if not a medicine-man, knows a much greater catalogue of names than nine-tenths of Americans. Nothing escapes him—he has a name for everything. And, indeed, there is reason. In times of great scarcity they are driven by the sore pangs of hunger to test everything that the soil produces, if perchance they may find something that will appease the gnawings of appetite. They therefore know the properties of all herbs, shrubs, roots, leaves, whether they are poisonous or nutritive, whether purgative, astringent, sedative, or what not, or without any active principle. And they have often found out these things by bitter experience in their own persons. It is surprising what a number of roots, leaves, berries, and nuts the squaw will discover. She will go out in the spring with nothing but a fire-hardened stick, and in an hour she will pick a breakfast of green stuff, into which there may enter fifteen or twenty ingredients, though, of course, they are seldom reduced to this extremity nowadays. Her eye will be arrested by a minute plant that will yield her only a bulbous root as large as a large pea, but which the American would have passed unnoticed. The women are generally best acquainted with the edible matters; while the old men are the authority as to the medicines.

There are seventy-three vegetable substances mentioned in this paper. I am indebted to the kindness of Professor H. N. Bolander, who identified for me many plants that I was unable to determine. There are a few specimens which are so scarce, nowadays, owing to the ravages of stock, or so difficult to find in flower, that it was impossible to give their scientific names.

I will take this occasion to say that there are many substances popularly called "Indian medicines" which are humbugs, and which have been fathered upon the aborigines by patent-medicine men. Whatever is set down in this paper has been learned from the Indians themselves.

In regard to medicinal herbs and plants, their usages are peculiar and sometimes amusing. As the practice of medicine among them is a source of great profit and prestige, it is sought to be invested with mystery. The medicines always are crafty men, keen observers, reticent. An old doctor always clothes his art with a great deal of superstition, secrecy, and pompous solemnity. In answer to impertinent young questioners, he says his simples do not grow anywhere in that neighborhood; he is obliged to purchase them from tribes living at a great distance. I have known an old doctor and his wife, both as full of guile and subtlety as an egg is of meat, who always arose at the dead of night, crept stealthily out of camp, and gathered their potent herbs, roots, etc., then returned before any one was stirring, and concealed them.

The Indians referred to in this paper are the Neeshenams, of Bear River, and the flora is that of the extreme lower foothills of Placer County. Their general name for "medicine" is *wenneh*, which denotes "good"; but they frequently use the word "medicine," even among themselves.

To begin with the oaks, the species which produces their favorite acorns is the *Quercus Gambelii*, Indian name, *chacow*. They generally select those trees which have a free, coarse bark and large acorns. About the middle of October the harvest begins, when the Indian, armed with a long, slender pole, ascends the tree and beats off the nuts. A tree which has been well stripped looks as if it had been scourged in a mighty hail storm. The old men generally assist in carrying them home in their deep, conical baskets, and there the squaw's duties commence. Holding an acorn on a stone, she gives it a slight tap with a stone pestle called *sooneh*, to crack the shell, which she strips off rapidly. They are then dried and beaten to powder in small hollows on top of some great rock. The flour is soaked a few hours in a large hollow scooped in the sand, the water draining off and carrying away the bitterness; after which it is cooked into a kind of mush in baskets by means of hot stones, or baked as bread underground. The acorn which stands second in favor is that of the burr-oak (*Q. lobata*—Indian, *lowh*). In Placer County this oak seems to be more properly *Q. Douglasii*, as its branchlets are erect and rigid. There is an oak which they call *shuheh*, which seems to be something like a cross between the white and burr-oaks, having very white and coarsely rimose bark, and glabrous, shining, deeply *sinuate* leaves. But Professor Bolander pronounces this also *Quercus Gambelii*. The live oak is *haha; Q. Wislizenia*, *hammut;* the black oak, (*Q. Sonomensis*) *hanchu*. The acorns of these last are eaten only when they can procure no others. There is one other very small species called *cheepis*, found growing in the mountains; but I cannot determine from their description whether it is the chinquapin or the whortleberry oak.

The nut-pine or silver-pine is *toan, toanem cha*. It is a great favorite with them, the most useful tree they have, and they always regret to see an American cutting one down. The nuts are a choice article of food; and, burned and beaten to powder, or crushed up raw and spread on in a plaster, they form their specific for a burn or a scald. The pitch, and the mistletoe which grows on this pine, are very valuable, in their estimation, for coughs, colds, and rheumatism.

They set them afire, making a dense smudge, and then the patient, wrapped in a blanket, squats over it or stands on all-fours over it, and works and shuffles his blanket, so as to make the smoke circulate all through it, and come in con tact with every portion of his body. When an Indian has an arrow-wound, or wound or sore of any kind, he smears it with the pitch of this tree, and renews it when it wears off. In the spring, if food is scarce, they eat the buds on the ends of the limbs, the inner bark, and the core of the cone, (*taeh*) which is something like a cabbage-stalk when green. The cone-core and bunch-grass are boiled together for a hair-dye. They are as proud of their black hair as the Chinese; and when an old chief who is somewhat vain of his personal appearance, or one of the dandies of the tribe, finds his hair growing gray, he has his squaw boil up a decoction of this kind, and he sops his bleaching locks in it. The tar *shindac*, which is worn by widows in mourning, is made of hot pitch and burned acorns, powdered; it is removed by means of soap-root and hot water.

(In adding the word for "tree," or "bush," they generally suffix the syllable *em*, thus: *toan, toanem cha; paddit, padditem doo.*)

Chippa is the willow, the long twigs of which are used both for arrows and basket-making. In making an arrrow, the hunter employs a rude kind of turning-lathe, a couple of sticks held in the hand, between which the twig intended for the arrow is tightly clamped and twisted around, which rubs off the bark and the alburnum, and makes it round. The long, straight shoots of the buckeye, *poaloh, poalem doo,* are used for the same purpose. For the woof in basket-making they employ the wood of the redbud, (*Cercis occidentalis—paddit*) which is split up with flints or the finger-nails into fine strings, used substantially as thread. The willow twig is passed round and round the basket, the butt of one lapping the twig of the other, while the redbud strings are sewn over the upper and under the lower.

Cotoh is the manzanita. Its berries are a favorite article of food, and are eaten raw, or pounded into flour in a basket, the seeds separated out, and the flour made into mush, or sacked and laid away for winter. They also make quite an agreeable article of cider from them, by soaking the flour in water several hours, and then draining it off.

Alder is *shootoom;* poison oak is *cheetoc.* They are less easily poisoned by the latter than Americans; their children handle it a great deal while little. They eat the leaves, both as a preventive, and as a cure for its effects; though it sometimes poisons them internally, The women use the leaves freely in cooking; they lay them over a pile of roots or a batch of acorn bread, then lay on hot stones and earth. The bright red berries of the California holly (*Photinea arbutifolia—yoalus*) are eaten with relish; also, the berries of the elder, *nock*, and wild grapes—*peemen*. They call a grapevine a bush—*Peemenem doo.*

Soap-root, *howh*, is used for poisoning fish. They pound up the root fine, and mix it into pools where the fish and minnows have no way of escape, and at the same time stir up the bottom until the water becomes muddy. The minnows thrust their heads out of the water stupefied, and are easily scooped up. Buck-

eyes are used in the same manner. Soap-root is also used to heal and cleanse old sores, being heated and laid on hot. Both soap-root and buckeyes are eaten in times of great scarcity; they are roasted under ground thirty-six hours or more, to extract the poison.

For toothache, the remedy is the root of the California buckthorn (*Frangula Californica—luhum doo*). It is heated as hot as can be borne, placed in the mouth against the offending member, and tightly gripped between the teeth. Several sorts of mints, *heesuh*, are used in a tea or decoction for colds or coughs. Ague is believed to be cured by a decoction of the little mullen, (*Eremocarpus setigerus—badah*) which grows on black adobe land in autumn. Colic is treated with a tea made from a greenish-gray lichen, (*Parmelia saxicola—wahattac*) found growing on stones. For rheumatism, they take the leaves and stems of a parasite vine (*Galium—sheshem*) which grows up in the middle of the chaparral bush, heat or burn them, and clap them hot on the place.

Yellow-dock, *heet*, is a valuable specific in their pharmacopœia. In case of acute pain of any description, the root is heated hot, and pressed upon the spot. In the spring, the leaf is eaten boiled, for greens, together with clover and many other things.

Bunch-grass, *boopuh*, is the subject of superstition. They believe that the long, slender stalks of it, discharged as arrows from a little bow against a pregnant woman, will produce a miscarriage; also, that they will hasten the time of maturity in a maiden. There is another thing, which they call *wocoamah*, probably wild parsnip, which they believe to be a deadly poison. It will produce nose-bleed, and the people who keep it in their houses will surely die. I will here state that I cannot discover that the Indians ever used poisons to any considerable extent to rid themselves of enemies; if they did, it was the old medicine men, and they keep the matter a secret. The Indians profess to stand in great and perpetual dread of being poisoned by one another; and no one will taste anything handed to him by one who is not a member of his family, unless the other tastes it first; but they imagine a hundred cases of poisoning where one actually occurs.

Of grasses, they eat the seed of the wild oat, (*tootootem com*) but very sparingly. Wild clover, *cheewee*; alfilleria, *battis*; and a kind of grass growing in wet places, (*Melica—holl*) are all eaten raw when young and tender, or boiled for greens.

There are two kinds of mushrooms which they consider edible. The one of which they are fondest is called *poolcut*, and is a little round ball, from the size of a marble to that of a black walnut, found underground in chaparral and pine thickets. They eat it raw with great relish, or roast it on the ashes. Another kind is the *wachuh*, which grows in the ordinary form, brown on the upper side, chocolate-colored and deeply ribbed underneath, and easily peeled. It is eaten boiled.

Higher up in the mountains they find a root looking somewhat like cork, a piece of which they sometimes wear suspended to their clothing as a charm. It

is called *chook* or *champoo*. Indians of other tribes in the State invest different species of *Angelica* with talismanic attributes.

Under the popular name of grass-nut there is included a large number of plants with a small, round, bulbous root, all of which, with one exception, the Indians eat with much satisfaction. They are generally pried out of the ground with a sharp stick and eaten raw on the spot; but sometimes the women collect a quantity in a basket and make a roast in the ashes, or boil them. Most of them are by no means disagreeable to the civilized taste. There is the beaver-tail grass-nut, (*Cyclobothra—wallic*) the turkey-pea, (*Sanicula luberosa—tuen*) the purple-flowered grass-nut, (*Brodiæa congesta—oakow*) the tule grass-nut, (*coah*) a small bulb, with a single, wiry, cylindrical stalk, growing in wet places, which I could not identify; the climbing grass-nut, (*Brodiæa volubilis—oampoom wi*) sometimes planted by Americans for ornaments; the little soap-root, (*Chlorogalum divaricatum—poyum*) the wild garlic, (*Allium—cooeeh*) the eight-leafed garlic, (*shal*) the five-leafed garlic, (*inshal*) and the three-leafed garlic, (*wookwe*) the yellow-blossom grass-nut (*Calliproa lutea—ustuh*); the long-leafed grass-nut (*Brodiæa congesta*, although the Indians have a different name for it from that mentioned just above, namely, *yoang wi*) the white-flowered grass-nut (*Hesperoscordium lacteum—yowak wi*); and the wild onion (*Allium cepa—chan.*) There is one other grass-nut, with a black bulb, (*Anticlea—haccul*) which the Indians consider poison, although it probably contains no more poison than other members of the liliaceous family.

The list of greens which they eat in the spring is also quite extensive. Besides the grasses and the yellow dock above mentioned, there is the mask-flower, (*Mimulus luteus—pooshum*) two species of the *Angelica*, (*hen* and *oamshu*) which are difficult to determine; the California poppy, (*Escholtzia Californica—tapoo*) either boiled or roasted with hot stones, and then laid in water; the rock-lettuce, (*Echeveris lanceolata—pittitac*) eaten raw; the wild lettuce, (*Claytonia perfoliata—yau*) and a species of *Sanicula*, (*mancoo*) the root of which, long and slightly tuberose, is also eaten. Of the wild lettuce a curious fact is to be noted. The Indians living in the mountains, about at the elevation of Auburn, gather it and lay it in quantities near the nests of certain large red ants, which have the habit of building conical heaps over their holes. After the ants have circulated all through it, they take it up, shake them off, and eat it with relish. They say the ants, in running over it, impart a sour taste to it, and make it as good as if it had vinegar on it. I never witnessed this done, but I have been told of it, at different times, by different Indians whom I have never known to deceive me.

Of seeds, they eat the following: A kind of coarse, wild grass, (*Promus virens—dodoh*) a species of yellow-blooming, tarry-smelling weed, (*Madaria—coamduc*) the seeds of which are as rich as butter; the yellow-blossom or crow-foot, (*Ranunculus Californicus—tiss*) of which the seed is gathered by sweeping through it a long-handled basket or a gourd; a little weed which grows thick in ravines, (*Blennosperma Californicum—poll*) gathered the same way; also a weed (*sheeoo*) with little white blossoms distributed all along the stalks,

which are thickly covered with minute prickles—I know not what it is. All these seeds are generally parched a little, and then beaten to flour, and eaten without further cooking, or made into bread or mush. The dry, parched flour of the crowfoot seed has that peculiar, rich taste of parched corn.

There is an umbelliferous plant, (*shokum*) the root of which the Indians esteem very highly for food; more highly than any other, it being their nearest equivalent to potatoes. I know not if it is the true cammas; I think it is at least a species of it. It grows on rocky hill-sides, blossoms in June and July, has an extremely delicate, fringe-like leaf, and a root about an inch long and a quarter as thick, sweetish-pungent and agreeable to the taste. In Penn Valley, Nevada county, they gather large quantities of it.

They are acquainted with the *Yerba santa*, but attach no particular value to it.

Around old camps and corrals there is found a wild tobacco, (*Nicotiana plumbaginifolia—pan*) which they smoke with great satisfaction. They gather the leaves and dry them in the sun in a rude fashion, then cut them up fine. It has a pungent peppery taste in the pipe, but is better than nine-tenths of the Chinese-made cigars. It is smoked in a wooden or stone pipe, which is constructed of a single straight piece, the bowl being simply a continuation of the stem, enlarged. I saw one made of soapstone, about six inches long, five inches of it being the bowl, which was nearly an inch wide at the extremity, so that it would hold enough to last half an hour. It was quite a handsome piece of workmanship, perfectly round and smooth, tapering evenly down to a bulb, which was inserted in the mouth. The tobacco-pipe is called *panemcoolah*.

There are two plants used for textile purposes. One is a kind of tule-grass, or small bulrush, (*Juncus—doccun*) which they hetcheled with flints or with their finger-nails, bleached, and wove into breech-cloths. For strings, cords, and nets, they used the inner bark of the lowland milk-weed (*Asclepias—poo*). When it is dry, the Indian takes both ends of a stalk in his hands, passes it through his mouth, and crushes it with his teeth, or else passes it over a stone while he gently taps it with another; then strips off the bark and twists it into strands, then into cords. The rock milk-weed, (*oampoo*) has a medicinal value; they use the root for the toothache, the same way the root of the buckthorn is used.

It is necessary to state that most of the medicines above mentioned are of the class which the women are allowed to become acquainted with and to employ. There are several other substances which are more rare and valuable, or at least they deem them more valuable, and which the medicine-men alone know anything about. They are found far up in the mountains or in other localities, and may be called the medicines of commerce, having a tolerably well-settled value in shell-money. I regret that I was generally unable to secure sufficiently complete specimens to determine them. For instance, there is a root (*luhno*) which I should call Seneca snake-root, but of which I could procure only a little piece. A root about as large as a pipe-stem, and four inches long, is worth about a dollar. A decoction of it is used for diarrhœa, that scourge of aboriginal life;

also for venereal diseases. There is a bush (*chapum*) found in the mountains, with a very pale tea-green bark, and minute golden specks on the small limbs, which is probably California sassafras, and which is very highly esteemed for coughs and colds, a tea of the bark being given. Another root, (*pallic*) spignet from its appearance, is made into a tea and drunk for diarrhœa; this also is very valuable. There is still another root, (*litway*) found on the Truckee, which is good for the dropsy.

Although it is not strictly germain to the topic, I may be permitted to state that the Indians have names for all the internal organs of the human body; and their ideas of their functions, and of the operations of medicine, are at least as respectable as those of the Chinese.

Regular Meeting, September 21st, 1874.

In the absence of the President and Vice President, Dr. Harkness was called to the Chair.

Thirty-nine members present.

Donations to the Museum: Four jars of alcoholic specimens were received from John C. Merrill. Twenty-one fine specimens of fossils, and six jars of alcoholic specimens from Alaska, were received from the office of the United States Coast Survey; accompanying these specimens was a letter from J. S. Lawson, dated U. S. Coast Survey Brig *R. H. Fauntleroy*, Admiralty Inlet, Washington Territory, August 1st, 1874, as follows:

On behalf of Captain Charles Willoughby, sailing master of this vessel, I send, for the California Academy of Sciences, two cases containing some teeth, portions of tusks and of bones, supposed to be remains of the *Elephas Primigenius*. These were found on the beach at Scatchet Head, Whidley Island; and as their appearance indicates—all being thickly encrusted with small barnacles when picked up—they have been subjected to the action of water for a long time. I am informed that some fourteen years ago a large slide took place at this point, since which time portions of these remains have, from time to time, been picked up. One tooth then found, and now in possession of Arthur Phinney, Esq., of Port Ludlow, shows no sign of having lain in the water.

Captain Willoughby has climbed the bluff in several places whenever he could make an ascent, but could not find any of these remains. Those now

sent were wholly, or nearly so, buried in the sand, at a considerable distance below high-water mark.

Cropping out from the bluff at high-water mark is a stratum of a woody fiber—possibly in one of the incipient stages of coal formation. In it are found sticks, knots, etc., of an extremely fine grain. This lignite, if it is such, in drying separates into laminæ, like the layers showing the growth of trees, and when dry makes good fuel. This formation is frequently found here. I have seen large quantities in Useless Bay and on the beach, east side of Bainbridge Island, south of Point Monroe. A specimen of this will be found with the collection now sent.

Immediately above this formation is a concrete, composed of small boulders and cement, showing traces of iron rust. The great body of the bluff is clay.

The portions of a tusk were found in the same fragmentary condition as they are sent. Captain Willoughby has marked some of these pieces, showing the parts belonging to each other.

We hope this collection may prove of interest. In one of the boxes I send several bottles, containing specimens of fish and other marine animals, which we have collected along these shores. The nondescript in the largest bottle was brought in by some fishermen at Port Townsend—I think from the Straits of Juan de Fuca.

On the Crustacea of California.

BY W. N. LOCKINGTON.

Next to the vertebrates, the creatures with an internal skeleton—mammalia, birds, reptiles, and fishes—come the multitudinous species comprised in the articulate sub-kingdom. All articulates possess an external skeleton, which may be leathery, or hard and brittle; a body divided into several segments; and limbs, when limbs are present, formed of several articulations or joints.

This sub-kingdom includes the insects; the arachnida, or spiders and mites; the crustaceans, the myriapoda, or centipedes, and the annelida, or worms.

In complexity and perfection of organization, as well as in general intelligence, the insects, which have a distinct head, with well-developed organs of sense grouped upon it in close proximity, are certainly entitled to rank first.

The crustaceans, or insects of the water, as they may be called—since crabs, lobsters, shrimps, and their congeners fill the same place in the seas and rivers of the globe that the insects fill in the air and upon the land—must be placed lower in the scale of animal life, since their most highly developed forms are not possessed of a distinct head, but have the mouth and organs of sense grouped upon the anterior part of what would, in the insect, be called the thorax. The body of a crustacean, therefore, is not constricted, as is that of the insect, into three distinct portions—a head, a thorax, and an abdomen—but either presents only two such divisions—an anterior one, usually denominated the *cephalo-thorax*, or head-thorax, since it contains the organs found in the head and thorax of an insect, and the abdomen, which corresponds to that of an insect; or else is dis-

tinctly divided into several segments, as distinct, though not as numerous, as those of a myriapod. All insects breathe by means of tracheæ, or air passages, which, communicating with the air at various points on the outside of the body, ramify among the internal organs, limbs, and wings, and act the part of the lungs of a vertebrate. All insects are thus air-inhabiting and air-breathing, and although some are adapted to live during the greater part of their lives in the water, they are compelled, like the cetaceans among the mammalia, to come to the surface to breathe. Almost all the crustacea, on the contrary, breathe, like fishes, the air contained in the water, by means of some modification of branchiæ or gills; and although some of them live on the land during the greater part or the whole of their lives, they are compelled to choose damp situations, so that their branchiæ may be kept moist, and thus be enabled to continue their functions.

All insects pass through a more or less complete series of metamorphoses, the three most conspicuous stages of which have received the names of *larva*, or caterpillar, *pupa*, or chrysalis, and *imago*, or perfect insect. All the crustaceans change their form somewhat before arriving at maturity; but it is only in the higher groups that these are sufficiently marked to entitle them to the name of metamorphoses. But there is this difference between the metamorphoses of the insect and those of the crustacean: the insect, whether its metamorphoses be complete, as in the butterfly, or partial, as in the cricket, attains its full size before assuming its imago state; indeed, the caterpillar is generally much larger than the imago. The crustacean, on the other hand, passes through all its incomplete stages while still very small, assumes its perfect form, and, as it grows, throws off its external hard skeleton and secretes another fitted to its increased bulk.

As late as the year 1838, Milne Edwards, in his "Natural History of the Crustaceans," wrote: "We are not acquainted with any crustacean from the western coast of North America." James D. Dana, in his "Crustacea of the United States Exploring Expedition," describes several species found between San Francisco and Puget Sound. J. W. Randall, De Saussure, and other zoölogists, also described other species.

The late Wm. Stimpson, in an article published in the "Boston Journal of Natural History," 1857, describes many new kinds, and catalogues a total of one hundred and thirty species belonging to, and peculiar to, the Pacific Coast. Stimpson, like his predecessor Dana, did not explore south of San Francisco. Since his day no one appears to have given any connected attention to the subject; and when we consider that the unexplored portion extends through Lower California, Sonora, Mexico, and Central America, as far south as the Isthmus of Panama, through a region tropical or sub-tropical in climate, and teeming with life of every kind, we shall, I think, fully endorse Stimpson's opinion, when he says, "We cannot suppose this number to be more than a fourth part of that which will be reached when a thorough search shall be instituted."

Ninety-six of the species enumerated by Stimpson belong to the highest division of the class, viz: the *Podopthalmia*, or stalked-eyed crustaceans; and

the remainder, with one exception, to the highest order of sessile-eyed crustaceans, the *Choristopoda*—species with fourteen legs, like the wood-lice, water-slaters, and sand-hoppers.

Below these come the numerous microscopic forms of fresh-water and marine crustaceans, as well as the sucking *Lerneans* and *Caligi*, and the *Cirripedes*, or barnacles, none of which, so far as I know, have as yet received special attention on this Coast. Out of Stimpson's ninety-six stalked-eyed species this collection does not at present possess more than about forty.

Fortunately, however, we have here several species not mentioned by Stimpson. Among these is a swimming crab, of the genus *Amphitrite*, collected at Mazatlan by Mr. H. Edwards. When Stimpson wrote, no species of swimming crab had been found upon the Pacific Coast, but Dr. Cooper informs me that the specimen we have is by no means the first found, as he had previously collected specimens of a species of the family upon the southern coast of California. The swimming crabs, or *Portunidæ*, as they are named, (from the genus *Portunus*, to which many European species belong) may be distinguished by the expansion of the last joint of the hindermost pair of feet into an oar-like form. They are numerous on the Atlantic coast. Only four species belonging to the *Cancridæ*, the typical crabs, are enumerated by Stimpson, and all of these belong to one *genus*—*Cancer*. This genus is distinguished by the extreme narrowness of the front, or space between the eyes, and by antennæ, which project forwards.

The common edible crab of the San Francisco market, *Cancer magister*, belongs to this genus, as does also the edible crab of Great Britain. In this museum we have four Pacific Coast species belonging to another section of the same great family—a section characterized by a front seldom less than one-sixth, and sometimes as much as one-half, the entire breadth of the carapax, or shell.

Another novelty is a species of *Gelasimus*, or fiddler crab, as it is popularly called. The females of this genus have the first pair of feet of ordinary proportions, but the males are blessed with a right hand of amazing size, longer than the width of the body, and terminating in an immense pair of pincers. These *Gelasimi* do not live in the sea, but in salt marshes, where they abide in holes, like toads in the garden—a pair usually inhabiting each hole. When the animal is disturbed or aggressively inclined, this tremendous right hand is brandished aloft in a most comical fashion, and when he has reached his home he bars the entrance with the same useful member.

The specimens are from San Diego.

I have now only to say a few words about some of the species common in or just outside the bay of San Francisco. One little fellow, who has been christened with the "barbarous binomial" of *Pachygrapsus crassipes*, lives in the crevices of rocks at or near high-tide mark. As the last joints, or tarsi, of his four hinder pairs of legs are set with sharp little spines, he can stick pretty tightly to the surfaces of the crevice; moreover, his pincers are sharp, and he knows how to use them, so that it is no easy matter to dislodge him. He keeps a good lookout, and usually sees you before you see him, withdrawing as far

backwards into the hole as he possibly can the instant he perceives that you have caught sight of him. He is perfectly ready to do battle with another of his species who may endeavor to trespass upon his cool cavern, and will pursue the trespasser to the limits of his premises.

If you turn over any of the large stones which cover the beach at Black Point, and similar localities, you are sure to disturb one or more of the pretty little crabs belonging to the genus *Pseudograpsus*. Sometimes as many as twenty, of all sizes, from half an inch or under to nearly two inches in width of carapax, will scuttle away from under a single stone. There are two species, but they live together in harmony, as becomes relatives. One species, the *Oregonensis*, is of a bluish-gray tint, and has a thin covering of hairs upon its hinder legs. The other, the *nudus*, is one of the prettiest crabs in existence. Its large pincers are marbled with dark purple spots on a lighter ground; the legs are of glossy smoothness, and the carapax of a dark purplish red.

Several species of hermit crabs—little crabs with a soft abdomen, which they protect by ensconcing it in the shell of a defunct mollusk—are found in and near San Francisco. Each individual chooses a shell to his fancy, and abandons it for a larger as his bulk increases.

There are several genera—those with the right hand largest, and the fingers or pincers pointed and calcareous, from the genus *Eupagurus;* those with spoon-shaped fingers, having horny tips, and the left hand usually largest, are known as *Paguri;* while others, which agree with the last in having spoon-shaped, horny fingers, but have hands of nearly equal size, and fingers opening horizontally, form the genus *Clibanarius*.

Another curious little crab, with a long, narrow body, and a pointed abdomen folded beneath it, is not found alive between tide-marks, but its body is often washed up by the tide on the sandy beaches just outside the bay. I have said its body, but it would be more correct to say its shell, since the body has usually been eaten clean up by a legion of sand-hoppers, which jump out of the shell in all directions when you pick it up. The name is *Hippa analoga*.

Another little crustacean bears the name of *Porcellana rupicola*, the rock-inhabiting porcelain crab. It dwells under rocks, in company with the *Pseudograpsi*, and is abundant at Black Point. The antennæ are very long, and folded backwards; the carapax is almost circular and flat; the hands are long, broad, and flat, and the fifth or hindermost pair of legs are very small, and olded up over the shell.

Two other species of *Porcellana*, one of them new to the Pacific Coast, were found at Mazatlan by Mr. Edwards.

The hermit crabs, porcelain crabs, and the long, narrow *Hippa*, unlike as they appear, belong to the same tribe of the ten-legged crustaceans, viz: the *Anomoura*, so called from the usually anomalous condition of the abdomen, which is seldom short and folded under the thorax, as in the *Brachyura*, or true crabs, nor yet long and fully provided with appendages, as in the lobster.

Another singular family, belonging to this tribe, is that of the stone-crabs, or *Lithodia*. In this family the fifth pair of feet are apparently wanting, but are

really present, and may be found folded up over the back, but concealed beneath the carapax.

Nine species of this group are known to inhabit California, but this museum only possesses three of them. One of these is as singular as it is rare. Few other collections possess specimens of it, and this has but one. The most striking characteristic of this species is the great development of the carapax, a part which, in most *Anomoura*, is of moderate size, but which, in this case, forms a broad, thin shield, of such dimensions as to completely conceal the legs, antennæ, abdomen, and every other part viewed from above; in fact, this crab presents nothing but an uneven, brown surface of shell, with a hooked rostrum projecting, vizor-like, from its anterior extremity, and enabling the animal to see without being seen. The other two species of stone-crabs belong to a genus peculiar to this Coast, and are among the largest crabs known, attaining a weight of seven pounds, and a width of carapax of ten inches.

Among the long-tailed crabs, or *Macroura*, there is a family differing greatly in habits from our well-known lobsters and shrimps, inasmuch as its members excavate subterranean habitations in the sand of the sea-shore, and are, therefore, not often observed unless properly sought for. A specimen of one of these was obtained upon the beach of San Miguel Island, by one of the Coast Survey, and presented to the Academy by Prof. Davidson, several months ago. It belongs to the genus *Callianassa*, distinguished by its soft, thin shell, and smooth carapax, as well as by the disproportionately large size of one of the hands, which may be either the right or the left in the same species. This species is *Callianassa Longimana*. Two other species of this genus, *C. Californiensis*, of which we possess an example, and *C. gigas*, which is larger than the others, and is yet wanting in our collection, are found on this Coast.

Another digging crustacean, *Gebia Pugettensis*, also found here, may be known by its equal hands and heavy rostrum.

My object in this paper is mainly to draw the attention of the members of the Academy to this branch of Zoölogy, and to induce those who have the opportunity to be on the look-out for crustaceans, as well as for birds and insects.

S. C. Hastings read short papers "On Thunder Storms"; "On Transmission of Musical Sounds by Telegraph"; "On Transmission of Colors by Telegraph"; "On Katie King and the Spiritualistic Theories"; "Questions to the eminent scientist, A. R. Wallace"; "On the Creeping of Rails on North and South Railroad Tracks."

Remarks on California Coal.

Dr. J. G. Cooper made some verbal remarks on California coal as follows:

The papers contain every day several notices of discoveries of coal in California, and always mention them as excellent indications, certain to be rich.

From these one might suppose that California would soon eclipse all other parts of the world in coal production, but the fact is, that in ninety-nine cases out of one hundred these discoveries are of no value whatever. He had examined such coal strata in over one hundred localities between San Francisco and San Diego, besides some in Sonoma and Marin Counties.

Although the unscientific sneer at geological facts and fossils as not practically useful, they are really the only reliable guides in determining the age and probable value of coal deposits. The true coal of the carboniferous rock in other countries was formed from the tree-ferns, algæ, and other plants of low organization.

None such had been found on this Coast, and from the fact that ours contained remains of coniferous and dicotyledonous trees, geologists had long considered it all as lignite; but practically that of Vancouver Island, Bellingham Bay, Coos Bay, and Mount Diablo was as good as much of the older coal. The most northern localities mentioned had been determined beyond doubt by the fossils as of cretaceous age, but there is still some doubt as to those of California, which may be partly or entirely above the cretaceous strata, like the Rocky Mountain coal, which is generally considered eocene.

This, however, does not affect the value of fossil evidence, as the species of both these formations are mostly extinct, and any coal found associated with fossils of living species must be of later date. No paying beds of coal have been found anywhere of later date than these.

It does not follow, however, that because a stratum is cretaceous, it will pay. Numerous strata in that formation in the Coast Range are too thin to pay, though of pretty good quality. None will pay if less than two feet thick, and in most places a thickness of four feet is necessary, if the coal is no better, nor more accessible, than that of Mount Diablo. Much of the cretaceous strata is also so metamorphosed that the coal has been ruined by infiltration of iron and silica, with other minerals, the surrounding sandstones being converted into jasper or serpentine.

The fossil shells found in connection with this coal show that it was formed by accumulation of trees, etc., in shallow bays, at the mouths of rivers in fresh or brackish water, and therefore along the shores of older continents or large islands. Often these deposits have been sunk afterwards, and strata with marine shells have accumulated above them to a great depth, when all would be again raised above the sea. In the Coast Range cretaceous coal-strata exist, above which miocene tertiary strata, full of shells of living kinds, were deposited to a thickness of one thousand feet, but afterwards removed sufficiently to show the coal beneath.

The beds of undoubted tertiary age are numerous in the Coast Range, and usually show the vegetable structure so plainly as to be recognized as lignites by everybody, besides differing from coal in a more or less brown tint. Some lignites may pay for working, for local use especially, as they do in some parts of Europe. Nearly all of that in the coast Range is, however, in either too thin beds, or too full of sulphur and other impurities. In a few places it has been purified and hardened so as to resemble anthracite, apparently by the action of

subterranean heat, when the strata are in contact with igneous rock beneath them.

The lignite beds of Ione Valley and Lincoln appear to be of one age. The former is described by Professor Whitney in the State Geology, Vol. I, as being very soft material, approaching peat, and useful only for local consumption. It forms a bed seven feet thick, occupying several small basins in the foot-hills, apparently the beds of former lakes. Numerous fossil plants are found in it, and are considered by him to prove its pliocene tertiary age. The large deposits found near Lincoln, at a much lower elevation, show that this pliocene lignite probably occupies large portions of the Sacramento and San Joaquin Valleys, where marine pliocene fossils have long been known to exist, as well as fresh water and terrestrial fossils, which occupied it successively, as the country rose above the level of the sea. Much of this coal was, no doubt, formed in lakes, which in filling up left the present marshes.

Pliocene coal is also found in the Coast Range, but nowhere in paying quantity. Strata from an inch to a foot thick may be seen by any one visiting Long Beach, south of Lake Merced, where the pliocene strata, full of marine fossils, (which prove their age by the large proportion of living species) are uplifted with a dip of thirty to forty degrees to the northeast.

In an article in the Proceedings of the California Academy, Vol. IV, p. 244, Amos Bowman described and figured this pliocene formation as one of his "terraces," most of which exist only in his imagination. As seen from east of the bay, the top of the ridge at this point appears tolerably level, but the strata along the beach are plainly inclined thirty to forty degrees, and were so described in California Geology, Vol. I. At a distance of ten to twenty miles many such "terraces" may be seen along the ridges around the bay, but none of these ridges are really terraced in the upper strata, which are everywhere highly inclined.

True terraces, probably pliocene, do exist at low levels around the bay and in Livermore Valley, containing fossil remains of land animals. Dr. Cooper was investigating these when the survey was suspended last spring. The marine terraces described by Professor Davidson, in Vol. V, Part 1, do not extend within the mouth of the bay, or very near it.

There is a fresh-water deposit in the basin of San Pablo creek, containing thin beds of good lignite, full of fresh-water shells, indicating a lake deposit of probably the miocene age. The strata have been very much disturbed by volcanic action in all the places where Dr. Cooper has examined them, and are not likely therefore to be profitable.

Indications of the effects of the great volcanic convulsions about the end of the pliocene epoch, which destroyed the then existing tropical fauna and flora of California, (as described by Professor Whitney) are to be seen in the coast strata of all the counties so far explored north of the bay, as well as in the gravel terraces containing the remains of plants and tropical animals, described by Dr. Leidy in a recent publication on the "U. S. Geological Survey of the Territories." Why does not California see the importance of retaining and publishing such interesting discoveries within her boundaries?

The following resolutions offered by the Trustees, were read by the Secretary, and unanimously adopted by the Academy:

WHEREAS, The will of a Divine Providence has taken from our midst our fellow-worker, Hiram G. Bloomer; therefore, be it

Resolved, That this Academy desires to record its sincere and earnest regret at the loss of one of its members, so honored for his gentle and kindly nature, so respected for his principles of truth, so worthy of admiration for his enthusiastic love of science, and his generous desire ever to impart information, as the friend who has been recently called away from us; and its belief that by the unexpected death of Mr. Bloomer a gap has been caused in the ranks of its officers which it will be difficult to fill.

Resolved, That in the loss of Mr. Bloomer we recognize the departure from amongst us of a brave and noble spirit, who, amid many of the hardships of life, clung persistently to the pure love of the beautiful, and who, in his unselfish devotion to his favorite pursuits, has left an impress upon the future of our State which in after years will be more fully recognized and known.

Resolved, That we deeply and sincerely sorrow over the sad and sudden bereavement which Mr. Bloomer's family have sustained, and offer to them our heartfelt sympathy in the hour of their affliction.

Resolved, That these resolutions be printed in the Proceedings of the Academy, and that a copy of them be forwarded to the immediate relatives of the deceased.

In moving the adoption of the resolutions, Prof. Bolander recounted the great services the deceased had rendered the Academy. His devotion to the cause of science had doubtless hastened his death. Mr. Bolander made a supplementary motion that a committee of five be appointed to examine the late Mr. Bloomer's library and herbarium, with a view to purchase. This motion was adopted, and the Chair appointed as such committee, Prof. Bolander, Dr. Kellogg, Henry Edwards, R. E. C. Stearns, and W. G. W. Harford.

Regular Meeting, October 5th, 1874.

Vice President in the Chair.

Forty-seven members present.

H. F. Teschemacher, a resident member, was enrolled as a life member, having paid the required fee.

Donations to the Museum: William J. Fisher presented a Collection of Japanese Specimens, including two pair of shoes and a hat; a sample book containing several hundred specimens of fabrics, a water-proof coat manufactured of paper, sponges, etc. W. G. W. Harford presented thirteen species of Crustaceans from the island of Santa Rosa. W. J. Fisher presented twenty-three species of Crustaceans from the Sandwich Islands and Japan. J. L. Bray presented several specimens of Iron Ore from the northern part of Coos County, Oregon; two bottles of Gold-bearing Sand, from the ocean beach of same county, and a bottle of Platinum, found in black sand on the same beach. Dr. Kellogg presented a very extensive collection of Plants. Mr. Hoffman presented the Map of California, issued by the State Geological Survey. Dr. Cooper presented a specimen of a fungoid growth with the following remarks: A fire passing through a grove of willows scorched many without killing them. On the bark of these the sap afterwards exuded of a deep red color, and dried where exposed to the sun in transparent drops, resembling cherry gum but not gummy, bitter like salicine, and of a beautiful blood-red color. Where kept moist by the dews and fogs, this sap-like exudation soon began to vegetate into an orange-red fungus, which grew about two or three inches long, covering the bark which had become dead with a mossy growth. Though it would be supposed, according to scientific belief, that the spores of this lichen or fungus merely found a suitable place to grow in the scorched sap, it looked very much like a case of "spontaneous generation" of fungus from the sap itself.

Donations to the Library: Popular Science Monthly, September, 1874. Nature. Annales Physik und Chemie. Ordinance Mem

oranda, No. 18. Commercial Statistics of the Republic of Chile. Astronomical Register, September, 1874. Journal of Botany, September. Engineering and Mining Journal, Sept. 5th, 12th, and 19th. California Farmer. Sept. Proc. Society Entomology, 2d series, No. 2. Magazine Natural History, September. French Catalogue of Collections of Ornithology. Catalogue of Rare and Curious Books, Vol. XVIII, No. 4. Proceedings Royal Geographical Society. American Naturalist, September. California Horticulturist, September.

California during the Pliocene Epoch.

Dr. J. G. Cooper made the following remarks on California during the pliocene epoch :

The map here exhibited is that of California and Nevada, published by the Geological Survey,and of which this new edition, issued by authority of the University of California, is presented to the Academy by the chief topographer, Mr. C. F. Hoffmann. On this there are pinned pieces of orange-colored paper, (chosen from its contrast with the blue and brown tints of the map) to represent the portions now land, but covered by salt or brackish water during the epoch just preceding the age of man. A considerable part of those along the edge of the coast is, however, omitted, being too narrow to show on this small scale at a distance. Probably much of the Coast Range was also under water, of which no evidence from fossil remains is now left, the strata, if any were deposited, having been washed away.

Numerous small fresh-water lakes also existed, which have left deposits, especially on the slope of the Sierra Nevada, but are not yet surveyed enough to define their limits. The Sierra must then have been much lower to allow these lakes to stand where they would now drain out completely. Most of the States of Nevada and Utah were also covered by large-fresh water lakes, filling what is now called the "Great Basin," and which have since evaporated so as to form the salt lakes now existing by condensation of the salts always contained in lakes and rivers. This is shown by the deposits of fresh-water shells at high levels above the present salt lakes, and the absence of salt-water fossils later than the cretaceous in the Great Basin.

In California, the whole great interior basin of the Sacramento and San Joaquin Valleys was occupied by brackish water, as proved by the remains of sharks and porpoises found by Professor Blake and others near Kern River. All the principal level valleys, now forming our best agricultural lands, were also occupied by arms of this island sea or of the ocean. The Gulf of California extended over the desert a hundred miles or more north of its present limits.

The Sacramento basin had other outlets besides the Golden Gate, (if that existed at all) through an inlet opening at Russian River, and another through

Santa Clara Valley into Monterey Bay. Thus, many islands probably existed, which are now joined by the main land, among them the peninsula of San Francisco. Some of the inlets near the coast were occupied by marshes, through which the animals of that period reached the nearest islands, as shown by the remains of the fossil elephant found near this city. Similar remains found by Blunt and Harford, of the Coast Survey, on Santa Rosa Island, show that it was then either joined to the main land by dry ground or marshes, as were probably the whole inner row of islands now forming the south shore of the Santa Barbara channel.

The evidence of all these changes is in the remains of marine, land, and fresh-water animals now found in the valleys mentioned, which have become more or less filled up by deposits from the adjoining hills.

The following are the most striking forms, described by Prof. Leidy in the "Report of the U. S. Geological Survey of the Territories," issued last year.

A tiger (*Felis imperialis*) as large as the Bengal tiger, found in or near Livermore Valley, by Dr. L. G. Yates.

Wolf (*Canis Indianensis*) larger than the existing kinds, from same deposit; also found in the tertiary of Indiana, etc.

Llama (*Palauchenia Californica*) from the foot-hills of Merced County, found by C. D. Voy, larger than the existing camel; also remains of perhaps another species, from Alameda County, by Dr. Yates.

Buffalo (*Bison latifrons*) found in several parts of this State and the Eastern States; larger, and differing from the living form. A very perfect skull was found by Mr. C. Brown, engineer of the Pilarcitos Valley aqueduct, in excavating for that work.

Horse, (*Equus occidentalis*) of which remains are common in most of the States, though no horses existed on this continent when it was discovered by Europeans.

Rhinoceros, (*R. hesperius*) of which teeth were obtained by Prof. Whitney, in the Sierra Nevada.

Elephant, (*E. Americanus*) one of the commonest of the great fossil animals throughout the United States.

Mastodon, (*Americanus M.*) more rare, but also found in many localities.

Another species, (*M. obscurus*) first found in the Gulf States, and since by Dr. Yates in the foot-hills of the Sierra, Alameda County, etc.

A great tortoise, equal to the Galapagos species in size, but probably of fresh water, from a lake deposit of Nevada County. This is still undescribed, being one of the fossils obtained by the University from the Geological Survey.

Remains of palms and other tropical trees, chiefly from the lake basins of the Sierra, were sent by Prof. Whitney to the eminent Prof. Lesquereux, to be described in one of the Geological Reports, that *ought to be* published by the State of California.

From these evidences we perceive that the climate of that day was tropical. The country consisted of peninsulas and islands like those of the present East Indies, resembling them also in climate and productions. From the extent of

water surrounding them, there was abundant rainfall and luxuriant vegetation, suitable for the animals mentioned.

It is not unlikely that some of these animals may have existed before and after the pliocene epoch as well as in it, but the explorations are still insufficient to decide this.

VOLCANIC ERA.

The termination of this tropical epoch in California was marked (as described first by Prof. Whitney) by enormous volcanic outbursts, which poured out great streams of lava on the slope of the Sierra Nevada, covering entirely large tracts toward the north. At the same time the whole country was apparently raised by the elevation of new mountain ranges and increase of old ones, causing the lakes to be drained, and their beds filled by washings from the hills, mixed with volcanic materials. This great convulsion, no doubt, exterminated most of the tropical flora and fauna of California, although some of its representatives might have existed later in neighboring regions, and their descendants may still be found in tropical America. That all are not extinct, is probable from the analogy of tertiary species elsewhere, and from the fact that most of the marine and fresh-water shells of the strata deposited at that time are still living; some, however, only south of California.

Many extinct land animals have been found to have lived in Europe since the appearance of man on the earth, and there is strong evidence in the "Calaveras skull," and others, that the same fact is true of California.

It does not, however, necessarily prove that man existed in the pliocene epoch, as his remains may have been buried under volcanic outflows of later date, together with postpliocene animals, or even bones of pliocene species mixed with them by aid of volcanic convulsions.

POSTPLIOCENE EPOCH.

The immense period of time that has elapsed since the pliocene epoch is shown by the vast accumulations of volcanic materials poured out by Mt. Vesuvius on top of marine strata of shells, of which every one of the species is said to be living in the Mediterranean, and therefore of late postpliocene date. Yet history and the evidence of human remains go back through only a thin portion of these volcanic strata! California, before the end of the pliocene, was certainly badly suited for the existence of man. The deposits formed during the convulsive era, to the thickness of hundreds of feet, are themselves almost destitute of all fossils, although burying such a rich collection.

While this was going on in California, there was probably a great geological change taking place in other parts of the world, followed by the glacial era. In this, the northern hemisphere, down to about lat. 41°, was mostly covered by ice, and the great deposit called the "Drift" formed in Europe and the Eastern States.

The Geological Survey proved conclusively that this deposit of erratic boulders did not reach over California, and it is doubtful if even as far south as Vancouver Island. Still, the influence of the frozen period was no doubt exerted

here in the forms of extensive glaciers covering the Sierra, at least half way down their western slope, and probably the highest parts of the Coast Range. *Now* we have in summer a mere remnant of that great ice field, which no doubt did a great part in the excavation of the tremendous cañons now cut deep below the previous volcanic deposits of the Sierra. The thawing of such an ice field must have acted much more rapidly in this erosion than the comparatively slight water courses of the present time. There is evidence, also, in the present existence, of far northern land-shells and plants along the whole length of our Sierra Nevada, that the glacial period progressed slowly, allowing them to spread southward before its advance, without being exterminated.

PRESENT EPOCH.

The end of the reign of ice brings us to the present epoch, in which there has been very little change in the outlines of the land of California, although some changes have occurred in the fauna and flora, as well as climate, which are yet undetermined. The volcanic disturbances have continued with decreasing intensity since the advent of man in the postpliocene epoch, and may have elevated considerable portions of land, especially southward, followed by increase of dryness and probably greater extremes of temperature. A rising of land near the Arctic Sea would further decrease the temperature. Judging from the continual discoveries still being made in the study of these latest formations of the earth's surface in Europe and the Eastern States, we may safely say that a vast field still remains open for the investigations of science in California.

Professor Hilgard, of the University of Michigan, and at present delivering a course of agricultural lectures at the State University, was introduced by Mr. Stearns. After congratulating the members on the flourishing condition of their organization, the number present greatly surpassing that of ordinary meetings of scientific bodies in the Eastern States, Professor Hilgard made some reference to the remarks made by Dr. Cooper, and then made a few remarks on the geology of the country north of the Gulf of Mexico, comparing it with the geology of this coast.

The California Aborigines.

BY STEPHEN POWERS.

In the *Atlantic Monthly*, of March, 1874, there was published an article entitled "Aborigines of California," in which I presented facts tending to show that these aborigines are descended from the Chinese. The conclusions which were arrived at in that paper have been questioned, on the ground that, however great may be their likeness to the Celestials, they cannot be descended from them, since they have no pottery, no hieroglyphics, and no monuments; and the time

never has been in the historical period when the Chinese were without these. It is argued that no people could lose the art of pottery, or even if they lost the art itself, that the pottery would remain, being almost indestructible. It is not intended to rehearse in this paper the arguments there presented in favor of a Chinese origin, but merely to offer some facts and suggestions as to these Indians and their predecessors on this coast.

The Voy Collection, in the University Museum, contains a large number of pre-aboriginal stone implements; but there is no link to connect the race who made them with the present one except *per deterins*. In fact, since the California Indians of to-day have no monuments or pottery, there is no link except those of language, customs, etc., to connect them with *any* race; hence the consideration of monuments and the like is pretty much eliminated from the discussion, as between them and the Chinese. Even if the very few remains found to-day served to prove that a pre-aboriginal race brought the ceramic art from China and practiced it here, it would still remain to show that that people were the ancestors of the California Indians. There is a gap somewhere, which cannot be passed except *per soltum*.

The simple fact of the almost total lack of ceramic remains, and the character of the relics found in the Alameda and other shell mounds, show that the present race must either have supplanted or descended from one which was little more advanced than themselves. The few and simple stone implements used by the California Indians resemble, in their main purpose and design, those of the extinct races exhumed in the shell-mounds, only they are conspicuously ruder and simpler. Take the stone mortars, for instance. The pre-aboriginal mortar is carefully dressed on the outside, and has three general shapes: either flattish and round, or shaped like a duck's egg, with the bowl on the side, or with the bowl in the large end, and the small end inserted into the ground. But the Indian takes a small bowlder of trap or greenstone, and beats out a hollow in it, leaving the outside rough. Whenever one is seen in possession of a mortar dressed on the outside, he will acknowledge that he did not make it, but found it; in other words, it is pre-aboriginal. The pre-aborigines used handsomely dressed pestles, evenly tapered to the upper end, or else a uniform cylinder for about three-fourths of the length, with the remaining fourth also uniform, but smaller, for a hand-hold; but the squaw nowadays picks up a long, slender cobble, from the brook. The pre-aborigines fought with heavy knives, or swords, carved out of jasper or obsidian, which were, probably, used as daggers rather than as swords; that is, the combatants sought to pierce each other with the point, instead of dealing blows with the edge. The Indians of to-day fight with rough stones, such as they pick up, choosing those which are long and sharp-pointed; and their constant aim is to strike each other in the face with the points, just as their predecessors or ancestors probably did with their carved knives. The pre-aborigines made, out of sandstone or other soft stones, a small and almost perfect sphere, as an acorn-sheller; but the squaw nowadays simply selects a smooth cobble from the brook for this purpose. In the collection of A. W. Chase, Esq., of the U. S. Coast Survey, there are spin-

dle whorls of stone, some of them found in mounds made by extinct tribes, and others found among the Klamath River Indians and the Nome Lackees, all of which bear a close resemblance; and, in this instance, there is no perceptible deterioration in the workmanship. I strongly suspect, however, if the Indians possessing these implements had been closely questioned, they would have acknowledged that they found them, and did not make them, just as they acknowledge in regard of the superior stone mortars and pestles. That is, they are really indebted to their ancestors for them. Near Freestone, Sonoma County, I saw in possession of its finder, what was probably a spindle whorl of pottery—the only instance of the kind I know of. In regard to tobacco-pipes, the deterioration is not so manifest, for I have seen soapstone pipes of as handsome workmanship as any obtained from the mounds. But I still think there is deterioration shown, in the fact that the Indians nowadays use so many wooden pipes of the rudest construction; though we have no means of showing that their ancestors did not use equally poor ones, since their wooden pipes, if they had any, have perished. Then again, as to the shell-mounds themselves. I am of opinion that they are merely the accumulations of a race of men who dived for clams, as the Wintoons of the upper Sacramento do to this day, to a limited extent. In other words, the Wintoons and other tribes are descended from a people who were more energetic and industrious than themselves.

Langsdorff and La Perouse both mention that they saw many Indians with magnificent beards, but now they are almost totally destitute of beards. Whether the ever-increasing drought and dessication of the Pacific Coast, which have swept away the ancient forests, have also destroyed the beards of the aborigines, is a question I am not competent to determine.

The two "Village Sentinels," as the Eurocs call them, at the mouth of the Klamath, and the human head carved in stone near the Geysers, seem to be relics of former idolatry; and indeed the legends connected with the latter state that their ancestors were idolaters. Their religion now, if they can be said to have any, is a near approach to fetichism; that is, the worship of animals, such as the coyote, the white owl, the black eagle, etc. Fetichism is a lower form of religion than idolatry.

There are two legends—one among the Cahrocs of the Klamaths, and one among the Pallegawonaps of Kern River—which, in my opinion, are undoubtedly a corrupted version of some old zodiac-myth, and therefore point to a remotely semi-civilized origin for their narrators.

I might extend these instances and comparisons, but it is not necessary. The California Indians, like their predecessors, belong unmistakably to the Stone Age; and the fact that they have degenerated from a higher to a lower grade in that age, argues strongly that their ancestors, after crossing the sea, might have degenerated from the Bronze Age or the Iron Age of China.

For these reasons, I am disposed to believe that the California Indians have simply deteriorated from what we (perhaps erroneously) call a pre-aboriginal race; and ultimately, from the Chinese. Instances are not wanting where a people have retrograded from civilization almost to barbarism in the course of

many centuries. Witness the Fellahs, who are supposed to be descended directly from the ancient Egyptians. China itself, with all its vast populations, has stood still for twenty centuries; and a colony from it wandering into a new land, where the abundance of nature and the genial climate invited them to relax the efforts which a crowded community had necessitated for the maintenance of life, might degenerate to a low point without difficulty. When the Chinese of to-day come to this land of plenty, how poor are the dwellings and implements they construct for themselves, compared with those they used in China. How poor are our own, compared with those we made in the East!

I do not forget that the Indians, almost with one accord, attribute these superior stone implements to a race older and other than their own. There is also a Neestenaw legend which cannot be very well explained, except on the supposition of a reference to an earlier race of cannibals, from whom their forefathers suffered grewsome damage. On the other hand, they all insist that their progenitors were created from the soil where they now live (to take all their accounts, there must have been a hundred of these "special creations" in California); so that their legends are not consistent.

The theory of degeneration above advanced, is quite in accord with the climatic changes and the deforestation which have taken place on this coast, even within the historical period. We know, from the statements of Biscayno and other early Spanish explorers, that extensive forests were flourishing near San Diego and Monterey, three hundred years ago, where now there are none. Biscayno says the natives of Santa Catalina Island had large wooden canoes, capable of sea voyages, whereas that island is now comparatively treeless. Fossil remains have been discovered in Southern California and Arizona, which indicate that there were once heavy forests where now are barren, wind-swept plains. Ruins of great walled cities, and large systems of irrigating ditches, in Arizona and New Mexico, on the Gila, Little Colorado, De Chaco, San Juan, and other streams, plainly show that these regions once contained an agricultural population, who were ultimately driven out by the ever-increasing drought and the failure of the streams. The great sequoias, on the high Sierra, may, perhaps, be the last lingerers of a gigantic race of forest trees, which the changed climatic conditions of California have destroyed from the plains.

We know that the deforestation of Babylonia, Assyria, Palestine, and Greece, has been accompanied by a corresponding deterioration of the inhabitants, and it may have been, also, largely the cause of it.

While there is nothing to show that the present race of California Indians are descended from an agricultural people, like the New Mexican Pueblos, there is much to show that their predecessors were superior to them, and that their predecessors were also their ancestors. The California Indians are simply a poor copy of the people whom we usually call pre-aborigines; but the copy follows the original so closely that there can be little doubt that it is a copy made by transmission.

In New Mexico, there is a large and powerful tribe called the Navajoes. There are good evidences that they are descended from the Hoopaws of this

State, and that they have migrated, within comparatively recent times, from the Trinity or the Klamath. Of these evidences I will here mention only one—the similarity of their numerals, as shown in the following table:

	HOOPAW.	NAVAJO.
One	Chlah.	Kli.
Two	Nach.	Nahkee.
Three	Tach.	Tah.
Four	Tinckh.	Dteen.
Five	Chwolch.	Estlahh.
Six	Hostàn.	Hostonn.
Seven	Ochkit.	Susett.
Eight	Cahnem.	Seepee.
Nine	Nocostah.	Nastyy.
Ten	Minchlah.	Niznahh.

The Navajoes to-day are superior to the Hoopaws, perhaps not in prowess, but certainly in the arts of peace. They possess the arts of weaving and pottery, which the Hoopaws know nothing about; but it is considered probable that they acquired those arts from the Pueblo Indians since their migration. Hence, the Navajoes offer no argument against the theory of degeneration. If they carried those arts with them from California, they powerfully confirm the theory, so far as the Hoopaws are concerned.

I offer this paper, not as an exhaustive treatise on this subject, but as giving some facts and theories which I hope others, more capable, will work out more fully.

The Committee appointed at the meeting of September 21st, to examine and report upon the library and herbarium of the late Mr. Bloomer, with a view to purchase, reported as follows:

SAN FRANCISCO, October 5th, 1874.

We the undersigned, the Committee appointed by the Academy to examine the library and botanical collection of the late H. G. Bloomer, desire to make the following report: The books are for the most part in excellent condition, and comprise a number of very valuable illustrated works on botanical science. In all, there are 117 volumes, of which at least half are folio or quarto, with illustrations. The botanical collection is in admirable order, and consists of sixty-six bundles of plants, many of which are rare species, not contained in the herbarium of the Academy. We have estimated the library and botanical collections to be worth at least seven hundred dollars, but in consideration of the inestimable services rendered to the Academy by the late Mr. Bloomer, we recommend that the sum

of one thousand dollars shall be paid for the same to his widow and family, in quarterly installments of two hundred and fifty dollars each.

(Signed) HENRY N. BOLANDER.
HENRY EDWARDS.
A. KELLOGG, M. D.
ROBERT E. C. STEARNS.
W. G. W. HARFORD.

On motion of Dr. Fourgeaud, the report of the Committee was unanimously adopted by the Academy, and referred to the Trustees.

Regular Meeting, October 19th, 1874.

Vice President in the Chair.

Forty-five members present.

Donations to the Museum: Dr. R. K. Reid, of Stockton, presented, through C. D. Gibbes, specimens of Wood and Fruit of the Osage Orange (*Maclura aurantiaca*); also, specimens of the Wood of the Walnut, a native of the lower Calaveras. Samuel Purdy, Esq., presented a Collection of Silver Ores from several mines in Colorado. D. D. Colton presented a section of Geode. H. L. Shackelford presented a Skull, supposed to be that of a female Indian, found in a bed of lava near San Francisquito creek. J. P. Dameron presented fifteen specimens of Coal and Lignite, found in various parts of California and Oregon. J. W. Lynch presented, through C. D. Gibbes, three specimens of Cinnabar ore, from Napa County, Cal. W. G. Blunt presented two Skate's Eggs, found on the beach near Point Lobos. Paymaster Stanton, U. S. N., donated specimen of "King Snake," (*Elaps euryxanthus*) from northern part of California. Chas. D. Gibbes presented materials showing the Dye obtained from the wood of the Osage orange. Henry Edwards presented two specimens of Crustacea,

genus *Squilla*, from Shanghai, China. Dr. Behr presented specimen of Parasite from the California orange trees, different from any previously described.

The usual exchanges to the Library were received.

J. P. Dameron read a paper on "Coal."

Some months since, Mr. C. D. Gibbes called the attention of Californians, through the Academy, to the Bois d'Arc or Osage orange, (*Maclura aurantiaca*) both for hedges and for timber. The wood is one of the most durable in the world, and is remarkably strong, elastic, and tough. It is of a beautiful yellow color, close grained, and receives a free polish, making it valuable for furniture. In Texas it is used for wagon wheels, as it is not liable to shrink. For ship-building, this wood is preferable to live oak, and by Indians is preferred for bows to all other wood. It also yields a yellow dye. For an ornamental tree, it is one of the most graceful, with its dark-green foliage and hard, smooth bark, drooping branches, and large, orange-colored fruit. It forms a good belt of hedge-row for sheltering gardens, vineyards, or orchards, being of a rapid growth and bearing formidable thorns for hedges. A plantation of Osage orange, set out now, would in a few years afford a most valuable timber that would pay well, as it sprouts rapidly from the stump and soon renews the timber cut.

Mr. Gibbes exhibited some of the wood, which had been sent to the Academy by Dr. R. K. Reid, of Stockton. Some of the wood had been polished, showing a beautiful grain. Some cloth dyed with the dye from this wood was also shown. The dye is of a bright yellow color. Mr. Gibbes again called the attention of our land-owners to the importance and value of cultivating plantations of this tree for timber. In swampy soil it grows very rapidly, and in our swamp land, firm enough to produce sycamore and willow, it would do well. It requires a good, moist soil, but not too wet. This tree could be used to great advantage in strengthening levees on the tule land, where it would not only be valuable for timber, fuel, and shade, but also for forming a substantial protection to the levees, strengthening them and assisting to hold them in position.

Notes on some Aleut Mummies.

BY W. H. DALL, U. S. COAST SURVEY.

I have previously given the Academy some account of the Aleutian method of mummifying their more distinguished dead. Many tales are current among the Aleuts in regard to particular cases of this practice, and among others one has been frequently related to me in regard to some mummies preserved in a cave on one of the volcanic islands known as the "Four Craters," or "Four Mountains." When in the vicinity, in 1873, we were unable to land and test the truth of this history, on account of bad weather and the absence of any harbors. More recently, however, this has been successfully done. The Alaska Commercial Company has a standing order to its agents to collect and preserve objects of interest in ethnology and natural history, and the cabinet of the Academy bears witness to the generosity of the company and the value of some of the material thus acquired. Captain E. Hennig, of the company's service, with the company's schooner *Wm. Sutton*, being employed in removing some hunters from the island of the Four Mountains, he was enabled, after seven unsuccessful attempts, to land at the base of the cliff, where the fallen rocks form a kind of cave, and was directed by the natives to the exact spot. Here he obtained twelve mummies, in good condition, besides several skulls of those which, being laid near the entrance of the cave, had become injured by the weather. There was also a moderate number of carvings and implements found, though some natives, less superstitious than the rest, had appropriated a quantity of weapons (reported to have once been there) for use in hunting. The island being volcanic and, in fact, still active, the soil is still warm, and the atmosphere of the cave was quite hot, which accounts for the extremely good preservation of the remains. Most of the bodies were simply eviscerated, stuffed with grass, dried, wrapped in furs and grass matting, and then secured in a water-proof covering of seal-hide. Two or three had much more pains bestowed upon them, and were of course of much more interest. The story of their deposition is too long to be given here, and is not particularly interesting, but it includes the fate of an old chief of the Island of the Four Mountains and his family, all of whom were buried in the cave. Among the others was a female, who died when with child from a premature birth, brought on by an accident, and the essential correctness of the tradition is attested by the presence of a little mummy of the still-born infant. The date of the first interment is very well fixed, by the fact that the old chief died the autumn before the spring in which the Russians made their first appearance at the Four Mountains; and, consequently, none of the bodies are much over 100 years old. Hence, they should not be confounded with the ancient pre-historic remains which I have formerly described in the Academy's Proceedings.

The mummies of real interest were few in number. The most conspicuous was that of the old chief. I am informed that this body was enveloped in furs, dressed in the usual native attire, and furnished with a sort of wooden armor,

formerly worn by the Aleuts. The whole was placed in a sort of basket, in a sitting posture, and carefully covered with water-proof skins, secured by lines made of sinew, either braided, or made into what sailors call "square sennit." This line, together with a net made of sinew, in which another of the bodies was secured, were very finely made, and nearly as perfect and strong as when first placed there. The matting, made of prepared grass, was exceedingly fine, in most cases far superior in finish and delicacy to any now made in the islands. One of the smaller mummies, in a triangular-shaped bundle or basket, had a pattern of a Maltese cross worked into a stripe of another color; this was quite fresh, and the grass still retained its red and yellow tinge. The largest basket has a wooden arrangement fastened with bone buttons, forming a broad hoop. which served it for a base. Most of the more carefully preserved specimens had been once suspended in the air by handles or cords attached to their envelopes.

The other articles found in the cave were stone knives and other implements, and a few carvings, one of which was supposed by the finder to be an idol, but this is probably an error. A child's boot of native make was found in the cave, with the fur perfectly preserved, and in it was a little ivory image of a sea-otter. A number of other bone and ivory toys or trinkets were also found. These articles are expected here on the bark *Cyane* in a few weeks, when those interested in these matters will probably have an opportunity of making a careful examination of them.

[Two of the mummies described above have arrived and are now in the Academy's museum, having been presented to the Academy by the Alaska Commercial Company.]

The following communication was presented by the Corresponding Secretary, on behalf of the writer:

Mesh-knot of the Tchin-cha-au Indians, Port Simpson, British Columbia.

BY GEORGE DAVIDSON.

The Indians of this section of the country use a "square" or "reef" knot in making their fishing nets. Other Indians may do so, but I have not seen them making their nets. This knot does not require the passage of the ball of twine through the mesh at any step of its formation, and therefore obviates the use of a netting needle. The twine is well made and strong, and is formed from the fibrous covering of the tall, rank nettles which abound around all their villages. They collect the nettles, strip off the leaves, dry the stalks, and when brittle, beat them until the woody parts are separated from the fiber. The specimens I obtained were about one-sixteenth of an inch in diameter; two ply, tolerably hard twisted, and fairly smooth. They also make twine from the inner fibrous bark

of the *Epilobium Angustifolium*. Those that I saw at work upon the nets were the dilapidated old women.

The following figures and explanation will show how the knot is made, and it can be very readily done by any one trying the experiment:

Bring the bight B *up* through the mesh A, as in fig. 1; draw the part D tight at C and press the left thumb upon D to keep the part J D around the mesh-block strained; pass the end E *up* through the bight B and haul tight to C, as shown in fig. 2, keeping the thumb as before on the partly formed knot.

With the free part D E of fig. 2, pass the bight F *down* through the mesh A, draw the part G tight upon the loop at C, when it will assume the condition exhibited in fig. 4, slipping the thumb on the part D, to keep tight the loop J around the mesh block. With the process in the condition shown by fig. 4, pass the end E *down* through the loop H and haul it taut, when the square knot, as at I, will necessarily appear by a slight movement of the thumb forward to aid it in settling into place.

Dr. Dall gave a brief synopsis of the results of his recent expedition to Alaska:

The season in the Arctic regions has been an open one and exceedingly auspicious for observations. The expedition has passed a greater portion of the time in the vicinity of Mount St. Elias. The scenery of that region was sublime beyond description, and the greatest glaciers were found there existing outside of the Polar seas. Much attention been given to measuring the altitude of Mount St. Elias and the neighboring peaks by careful triangulations, and it was determined beyond doubt that St. Elias is the most lofty point of land on the North American continent. Its altitude is calculated at 19,000 feet, and that of Mount Fairweather at 15,000. It is impossible, however, to fix the precise height of the lofty peaks until their ascent can be accomplished. Mount St. Elias has been commonly designated in the geographies as a volcanic cone, but an examination of its formation, as far as practicable, determined that this supposition is erroneous. Small volcanic vents are discovered, however, toward the sea. While sailing close in to the shore, a few miles north of Cape Fairweather, an immense glacier was inspected, having a flow from three to six miles in width, and extending inland beyond the reach of vision, which was at least thirty miles. The country was of a rolling formation and no material deviations appeared within the horizon in the direction of the glacier. The ice was clear and blue and glistening in the light, and presented a magnificent spectacle.

California in the Miocene Epoch.

BY J. G. COOPER, M.D.

Unlike the pliocene, which I spoke of at our last meeting, the miocene in California furnishes us, so far, with no *certain* evidence of land animals' ex-

istence, and few of vegetable life. It is, however, most probable that such existed, and will in time be determined or distinguished from the pliocene with which they are now mixed. That there was an extensive and most interesting terrestrial fauna in the adjoining regions of Eastern Oregon, Wyoming, and Utah has been proved by the treasures of animal remains found within ten years past in those regions, to enumerate merely the names of which now would take up too much time.

As there was much less land above water in this part of the continent during the miocene, the field for such animals to exist in was much more limited than in the pliocene, and, therefore, their history requires longer time to work out. Besides this, the convulsions and removals of animal relics from their original beds, during the volcanic and glacial periods, were so general as to mix them up in a manner too puzzling to be deciphered for a long time to come. An instance of this is shown by the tooth of an *Archegosaurus*, found by me on Mare Island, some years since, and mentioned in our Proceedings, Vol. V., p. 194. This tooth, identified by the lamented Agassiz, belonged to an animal believed to have been one of the earliest reptilian forms known, and characterizing the carboniferous age. It was an enormous development of the strange "four-legged fish," or larval salamanders still found in the Columbia River and other western waters, but must have been several feet long, and no similar remains are found in any later formations. Though it is not *certain* that they may not be yet found to have existed among the monsters of the pliocene epoch on this Coast, as their supposed descendants live in our fresh waters, still the evidence of this single tooth would have gone far to prove the age of Mare Island to be carboniferous if no other fossils had been found there. As it happens, however, to be one of the richest fossil-beds of pliocene remains in California, the single tooth found on the surface of that formation was probably transported by ice from the Sierra Nevada, where the nearest carboniferous strata are known to exist. Of course, the same may be the case with some of the pliocene remains, and possibly others elsewhere. But the peculiar position of Mare Island makes it the most likely place for such mixtures, as it lies just where the outlet of pliocene or post-pliocene lakes or rivers must once have met a great obstruction to their flow. On this, animals embedded in floating ice would naturally lodge and decay, just as the celebrated extinct elephant of Siberia was carried by ice to its resting place at the mouth of an Arctic river. The obstruction referred to was, no doubt, an elevation of the Mt. Diablo ridge, crossing the Straits of Carquinez at this point, during the volcanic period before mentioned. By this, pliocene beds were made to accumulate to a depth of over fifty feet, which they still show on the adjoining shores, though the rivers have washed away the obstruction itself, and the greater part of these beds also.

The fossil evidence which we possess relating to the miocene epoch in California is, however, abundant and interesting. It so far consists of beds of marine shells, found at short intervals throughout the Coast Range and the foot-hills of the Sierra Nevada, which contain the proper proportion of living species to prove their age as relatively older than the pliocene. From their compara-

tively recent date, it is not generally difficult to recognize and follow out these beds throughout their extent, though much more disturbed and altered by volcanic action than the pliocene. In some places, however, the contact of eruptive rocks or infiltration of foreign mineral matter by hot springs, has altered them past recognition, though for only limited tracts south of San Francisco Bay.

From these marine beds we find that nearly the whole of the coast ranges south of here were under the sea in the miocene, and the evidences of extensive washing away of the strata are so plain that it is not improbable that the *whole* were submerged.

Beds of excellent miocene, and, possibly, pliocene fossils, are found at the mouth of Kern River cañon, showing that the sea then washed freely against the foot of the Sierra; there is even reason for believing that it extended far up the Colorado River basin; and certainly it deposited a thick bed of the enormous miocene oyster, (*O. Titan*) with other remains, along the west shore of the present Colorado desert, now at an elevation of probably 1,000 feet. Of its extent in the northwest quarter of California very little is known, and probably most of that region was above water.

As these changes of level were caused by depression of the land below its present level, our mountains were then probably quite insignificant, and no doubt a much more level and uniform surface prevailed on shore. As the miocene was elsewhere the culminating period of existence for the large and strange tertiary mammals, it is altogether probable that some of them inhabited portions of the dry land of California, connected with the regions in which they were so abundant in the north; but, so far, the geological surveys have not been sufficient to define their limits, either in time or space, within this State.

That marine monsters frequented our shores is proved by the remains of seals, whales, and still undescribed creatures of enormous size, that have been found in this formation even more abundantly than in the pliocene of the Coast Range. From the great difficulty of obtaining their stone-imbedded relics, there will be work for future generations of students in describing them. From these animal remains (many of which were only of microscopic size) was produced the petroleum of this Coast, a substance so far found only in the miocene strata of California.

Of the miocene flora, as distinguished from the pliocene in California, we know very little. It was apparently of a less tropical character, more like that of the present time, and probably resembled ours now living as nearly as any other. Beds of lignite, four feet thick, but poor in quality, are common near the coast, containing wood and algæ.

The northern hemisphere seems to have had in the miocene epoch a very uniform climate, in which the vegetation of Europe resembled that now in our Eastern States. The most wonderful fact connected with it is, that recent discoveries have proved that Greenland, in lat. 70°, and Spitzbergen, in lat. 78°, 58′, had a rich luxuriant forest of trees, mostly American in character, among them a redwood, undistinguishable from that so common here! In all, 137 species

are known. It is impossible to reconcile this with the existence of even four months' night which we know must prevail so near the pole, even if the climate there were tropical. We are forced to the conclusion, in spite of astronomical opinions, that the poles have changed since then, and this may help to explain many geological puzzles both in California and elsewhere. Among these the supposed absence of all EOCENE animal or vegetable remains on this Coast is one which might be accounted for by supposing that in that epoch California was under covering of polar ice! Such a theory, though it may be called absurd on account of the present flattening of the poles by centrifugal force, is as tenable as that of the well-known alternations of deep ocean and dry land which geology proves to have occurred on our continent. I may mention in this connection, that Prof. Dana, during his explorations of the Oceanic Archipelago, saw reasons to believe that it has been slowly subsiding from the condition of a continent in the tertiary and recent ages, while this Coast has been rising. Thus, alternations of land and ocean have doubtless been going on, usually slow and gradual, since the creation of the world. The changes in fauna and flora, which in our limited field of view seem to have been sudden and convulsive, were probably nearly all through the tertiary, as slow as at present, but from these enormous undulations of the earth's surface, half of their history is for us buried beneath a fathomless abyss.

Would changes of the poles be any more wonderful or impossible?

Observations on the Genus Caprella, and Description of a New Species.

BY W. N. LOCKINGTON.

Among the *Tetradecapoda*, or fourteen-legged crustaceans, the best known forms of which are the pill-bugs, wood-lice, and sand-hoppers, there is no more remarkable genus than *Caprella*. The abdomen is obsolete, or so nearly so as only to be distinguishable by a most careful examination; and the entire body consists of the seven thoracic segments, each of which is exceedingly attenuated, so that the creature resembles, in its general appearance, a long, slender caterpillar more than a crustacean.

Although classed with the fourteen-legged crustacea, the *Caprellæ*, like their near relatives, the *Cyami*, or whale-lice, have really only five pairs of legs, as those pairs which normally spring from the third and fourth segments are absent, their place being filled, in the males, by two pairs of elongated branchiæ. In the females these branchiæ are modified in form and function, becoming four broad plates, which fold securely over each other on the lower side of the third and fourth segments, and thus composing a sac or pouch in which the eggs and immature young are safely carried.

The comparatively great length of the body is still further increased by the long, slender, external antennæ, and the backward direction of the hindermost legs; and the resemblance to a caterpillar is heightened by the mode of progression, which, on account of the absence of legs on the third and fourth seg-

ments, is by looping the body in a manner precisely similar to that practiced by the "loopers," or larvæ of the *Geometridæ*.

The first pair of legs is short, but the second makes up by its inordinate length and slenderness; while the three hinder pairs are more nearly equal in size, and are known as "anchoral" feet, since it is by them that the creature attaches itself firmly to the object on which it rests.

All the feet are provided with sharp claws, which fold back upon the preceding joint; but in the last three pairs this joint is furnished with a sharp spine, against which the claw shuts. Thus our *Caprella*, secured by six anchors, can ride safely in spite of waves and currents, its long body swaying to and fro, and its forelegs busy in catching its prey. The *Caprellæ* appear to be parasitic on hydroids and sponges.

The species of which I append a technical description was dredged in about eight fathoms of water, from a bottom of mud and weeds, in Hakodadi Bay, Japan, by W. J. Fisher, naturalist of the *Tuscarora*. Mr. Fisher has presented two specimens, male and female, to this Academy.

I believe the species to be new, although it is just possible that it may have been previously described by some naturalist whose works do not grace the shelves of our Academy. I have named it *C. spinosa*. The male somewhat resembles the *C. attenuata* of Dana, the chief differences being the spines upon the five posterior segments, and the absence of the spine upon the head.

The females differ so greatly from the males in the comparative lengths of the several joints of the body and antennæ, that I was at first inclined to believe they belonged to another species; but since the two forms were always dredged in company, and the specimens of one form are all males, while those of the other are all females, it is evident that they are the two sexes of the same species.

Caprella spinosa. Lockington.

Male. Body very slender; segments elongate, second thoracic segment more than one-half longer than the first, and very slender. No spine on dorsal surface of head. Superior antennæ longer than half the body; first joint little more than half the length of second; third joint nearly as long as second; flagellum rather longer than basal joint. Inferior antennæ reaching to about the first third of the second joint of the superior antennæ. Hand of second pair of legs very narrow, with three teeth on the underside, one a short distance behind the claw, a second close to the first, and a third posterior to the middle. The third and fourth segments have a sharp spine on each side, above the branchiæ and near the hinder margin, and the three posterior segments are furnished with similar spines.

Length of body, 1 11-16 inch. Length of superior antennæ, about 1 inch.

Female. Body less elongated than in the male; third and fourth segments swollen at the sides, and both these segments armed with a long, sharp spine, the point curving towards the head; fifth and sixth segments armed with a straight spine. Second pair of legs about as long as the second segment of

the body, the basal joint armed with a sharp spine on the upper side of distal end; hand shorter than basal joint, with a single acute tooth on the posterior third of the under side. Superior antennæ about half the length of the body, the second joint about one-third longer than the basal; flagellum as long as second joint. Inferior antennæ about equal in length to the first two joints of the superior antennæ.

Length of body, about 1 7-16 inch; of superior antennæ, ¾ inch.

Dr. Harkness stated that the Fungus presented by Dr. Cooper, at the meeting of October 5th, was of a somewhat rare species—*Meleancomes Stilbestoma*, Julasne.

Curious Electrical Light Observed during the Storm of September 30th.

BY JAMES BLAKE, M. D.

Being at Placerville, in El Dorado County, on the evening of the 30th of September, I was watching the lightning that was continuously flashing towards the southwest horizon, and I could not fail of remarking that the electrical discharges were the most continuous I had ever seen. About a quarter past seven, I observed a luminous appearance, apparently proceeding from the crest of a range of mountains about six miles to the southwest, the range that overlooks the Cosumnes River. The light was visible through an arc, horizontally, of about fifteen degrees, and extended about eight degrees above the horizon; the highest part was not exactly in the middle, but more towards the western end of the light. The general appearance was somewhat like a faint display of the aurora borealis near the horizon. I watched it about a quarter of an hour; at this time the light was becoming fainter, and on looking for it about twenty minutes later it had entirely disappeared. The light was undoubtedly electrical, and I am inclined to think it was due to the silent escape of electricity from the crest of the ridge, as such appearances have been observed in other mountainous countries during electrical storms; and there can be no doubt but that the storm in question was accompanied by the greatest electrical disturbance witnessed in this country since its settlement by the Americans. I would observe that the storm did not reach Placerville until about 2 A. M. on the morning of Oct. 1st.

Regular Meeting, November 2d, 1874.

Vice President in the Chair.

Forty-three members present.

Dr. Cornelius Herz was proposed as a candidate for membership.

W. H. Dall, having paid the required fee, was enrolled as a life member.

Donations to the Museum: Four specimens of Ores from Rattlesnake Mine, Sonoma Co., Cal., from H. Halsey; the same gentleman also presented two specimens from Mineral King District, Tulare Co. Specimens of Cinnabar ore from Great Western Mine, Lake Co. Specimens of Gravel Cement, containing gold, from L. D. Currie's Cement Mine, under the bed of the Stanislaus River, near Central Ferry, Tuolumne Co., Cal. Specimens of Crystallized Quartz, from the Geyser region. Mr. W. T. Reynolds presented ten specimens of Cinnabar ore, from Oakland Mine, Sonoma Co. Coll Deane presented speciimens from the Calistoga Mine, Napa Co. W. G. W. Harford donated specimens of Cuttlefish. W. H. Ford presented several specimens of Cadis Worm, found on the South Fork of the Stanislaus River. Larkyns & Co. presented a large Cuttlefish. W. H. Dall, U. S. Coast Survey, presented a bottle containing a variety of Shells from the South Sea Islands. General Colton presented specimens of Fossil Fish, found in a layer of lime rock at Church Buttes, Wyoming Territory. Mr. John Edwards, of Thompson Flat, about three miles north of Oroville, Butte Co., presented some Fossil Teeth and Leg Bone, found in a hydraulic mine in that location, at a depth of thirty feet, in a stratum of sand, close under a layer of pipe clay, and about ten feet above the bed rock. Many other bones were unearthed, but were very much broken by the hydraulic piping, and were washed away. Also, Bones of some small animal, found in an Indian rancheria.

Donations to the Library: Mining Journal for Oct. 10th, 1874;

Overland Monthly for November; Quarterly Journal of Microscopical Science for October, 1874; Magazine of Natural History, Oct., 1874; Proceedings of Society of Entomology of Belgium; Nature, Oct. 1st.

Two cones of the species of pine called *Sabiniana*, otherwise known as "wet pine," were presented by J. Begg, of Gilroy, through J. M. Willey. These specimens were found in the mountains back of Gilroy, and are peculiar for their symmetry.

Dr. Behr made some remarks on the *Eucalyptus globulus*. He had been informed by an Australian correspondent that the wood made excellent shingles, by reason of its non-inflammable characteristics.

A Recent Volcano in Plumas County.

BY H. W. HARKNESS, M. D.

From time to time, during the period between the years 1850 and 1854, vague rumors had been circulated that evidence of active volcanic action existed in the northern portion of Plumas County, and that strange lights had apparently been seen by different observers, which were referred to by them as the result of an eruption somewhere to the eastward of Lassen's Butte. As the Indians in the immediate vicinity were exceedingly hostile no effort appears to have been made to verify the correctness of these reports, and the subject seems to have dropped from the minds of men.

While traveling in Plumas County, during the past summer, I heard reports of the existence of a lava bed in the vicinity of Lassen, which bore traces of a recent upheaval, the central point of this disturbance being commonly referred to as the Cinder Cone. While camping in the neighborhood I had ample opportunity to make a pretty thorough examination of the locality.

This cone is marked upon the map as being within the limits of Lassen County. This, however, is a mistake, its true location being at a point which would place the whole, or at least the larger portion of the cone, with its outlying lava bed within the limits of Plumas.

Two lakes are laid down upon the State Geological Map as lakes Anna and Louisa; these lakes lie to the eastward and about twelve miles distant from Lassen's Butte, and are known to the residents in that portion of the State as Snag Lake (Anna) and Juniper Lake (Louisa). The Cinder Cone and lava bed which I refer to lie directly across the northern end of Snag Lake.

When viewed from the southern point of the lake—1½ miles distant—the lava bank rises directly from the water to the height of eighty or ninety feet, and extends across the whole breadth for a mile or more, with as regular a gradient and as sharp a definition as a railway embankment. The surface beyond is

studded with a few abrupt elevations twenty or thirty feet high, while to the left rises a huge cone with a crater at its summit. On the eastern end this lava embankment turns abruptly to the north as it strikes the lake shore, and from this point the line extends in a northerly direction for a distance of one and a half miles, or more, when it strikes another lake, or as is most likely, what was once the lower end of Snag Lake. At this point the line turns sharply to the west, the lava dyke crossing the lake to its western shore, when it again deviates to the southwest, until it strikes the lake line previously described. Nearly midway, on the western side, the Cinder Cone rises abruptly from the border of the lava bed, one side of it resting upon the plain. It will be seen that, should my estimate prove to be correct, the entire circumference of the lava bed is between four and five miles. For the entire distance, except at the cone, the embankment rises from the plain or water eighty or ninety feet, at a sharp angle of about sixty degrees, and in no instance is there in this border the slightest trace of a lava flow to indicate that it was in a molten state when thrown out.

The surface of the blocks shows a bright metallic luster, the colors varying in different parts of the field from black to a reddish brown. On climbing to the surface of the lava it is found to be very irregular, with ridges and depressions alternately, forming a surface so uneven as to make it very fatiguing to walk for any distance upon it. Near the center of the field I observed a mass of lava which showed signs of having been in a molten state when thrown upon the surface; this was a somewhat narrow strip, a hundred feet or so in length, lying in a horizontal position, but slightly broken, and its rough, uneven, corrugated surface clearly indicating that it had been cooled by contact with the atmosphere. A few sickly-looking pine trees—a dozen or two at the most—were struggling for existence, wherever a little collection of burnt earth rendered such an existence possible. These trees were quite small, being only two or three inches in diameter.

As I before stated, the cone rises from the western side of the field. In making the ascent I selected a point to the southeast of the cone, as the side there rests against the lava, and its level of a hundred feet can be reached without much effort. From this point, however, owing to the loose and sliding material, the ascent proved a very severe task, far exceeding anything I had previously undertaken.

Barometrical measurement showed the summit of the cone to be six hundred feet above the plain at its base, the exact height, I believe, of that of Vesuvius. It possesses a well defined outer rim of some six hundred feet in diameter. Within the rim, after a descent of about sixty feet, a level bench is reached, on which one may walk entirely around the inner crater, which is funnel-shaped, and about ninety or one hundred feet in depth.

The crater exhibits no signs of having contained water. A few small willow twigs are to be seen growing within the outer rim. Judging from the appearance of the lava bed, as viewed from the summit, and the present condition of the material, it would seem that the present cone has thrown out but a small

portion, if any, of the lava in view, but rather that it has been elevated by forces acting directly beneath the site it now occupies. The amount of ashes and pumice which have evidently been discharged from this cone is, however, amazing. In the immediate neighborhood of the cone the deposit is from twelve to twenty inches in thickness, and two miles away it is five or six. I traced this deposit for four or five miles to the southwest, and Obed Field, one of my guides, informed me that to the northwest it extends fully ten miles. To the eastward the deposit is not so extensive. Yet it is safe to say that a breadth of eighty or one hundred square miles has been covered by the ashes from this volcano. Small bits of pumice of the size of a bean are plentifully mixed with the deposit.

The ashes are of a dull gray color, differing in this respect from any other I had previously observed in the State; and as they offer but little resistance to the wind no signs of drifting are apparent, and they rest evenly upon the surface as they fell. My reasons for believing this volcano to have been of recent origin may be briefly stated. In Snag Lake, across which the dike of lava extends, there are several dead trees still standing, while on the lake shore are many trees and stumps battered and torn by ice, which have been driven upon the beach by the wind. This is notably the case upon the eastern border of the lake, where they may be counted by the hundred.

These facts clearly indicate that a large portion, at least, of what is now the bed of the lake has but recently been a forest, and that the presence of the lava has been the cause of the change in the level of the water. Again, along the borders of the lava bed there are a number of trees still standing with lava nearly or quite encircling them, their dead and blackened trunks furnishing incontestable evidence that the eruption occurred while they occupied their present positions.

To the west and northwest of the cone an open space exists of a hundred acres or more in extent, the trees upon which have nearly all disappeared. There exists, to my mind, the clearest evidence that the vegetation upon this tract was destroyed by the shower of hot ashes. The trees still standing are burned upon all sides, precisely as a green tree burns, a thin stratum of charcoal still adhering to the surface of the remaining wood. A few trunks have fallen, and they rest on the surface of the heavy ash, not partially buried in it. No traces are perceptible of fallen timber lying beneath the ash, as that would naturally have been entirely burned away.

I observed many concave depressions dotting this field of ashes. These depressions were from six to ten inches in depth and from one to four feet in diameter, with sides sloping towards the center. Where one of these occurred, on digging through the ashes I invariably found traces of a charred or decaying tree stump. In the forest beyond, the trees were invariably surrounded by a zone of ashes. Further evidence of this recent shower may without doubt be obtained by a thorough examination of the living trees in the vicinity. Many small cavities at the point where the branches are thrown off will yet disclose a store of ashes to reward the search.

A large number of trees still living in the adjoining forest show scars, and the new wood formed by the reparative process is apparently of but a few years' growth, although, as I had no ax, I was unable to verify this statement by count of the annular rings in the new wood. I had forgotten to state that there was one living tree in the field of ashes; but it has lost its top, and its scarred trunk indicates a desperate struggle for life.

I have endeavored to place before you this evening all, as I believe, of the more important facts upon which I base the supposition that this volcano has been in active operation within twenty-five years. Much of this evidence will soon disappear. The ice in another winter, perhaps, will have lifted the last tree from its place in the bed of the lake, the concave depressions in the ashes will gradually become less distinct, and the trees encircled in the stony embrace of the lava will soon decay; yet the characteristics of the volcano itself are so marked that it will, for a century to come, be recognized as of recent origin. I had traveled for weeks over a country every inch of which exhibited traces of volcanic action. Yet there always existed something to show that nature was endeavoring to repair the mischief which had been wrought. By disintegration the unsightly lava blocks were being converted into soil, on which vegetation was luxuriating and where animal life can find subsistence. I had climbed very many well wooded volcanic peaks to find that within the very craters large trees were growing, and the sides converted into grassy slopes. Here, however, the lava bed was as sharply defined as though it was a fortress in an open plain; and although surrounded on all sides by volcanic ruins, it appeared as fresh and new as though the creation of but a day.

Since my oral report to this Society four different gentlemen have furnished me with reports which, in my estimation, must be considered as corroborative proof of the existence of an active volcano about the period named. Dr. Wozencraft informs me that during the winter of 1850–51 he was residing at a point some distance above Red Bluffs, when he observed a great fire to the eastward of Lassen, which continued for many nights without change of position. The Doctor states that some of the observers expressed the belief, on the first night of its appearance, that it was the light from a large Indian camp-fire. The reappearance of the great body of flame for so many nights in succession, however, seemed to shake their faith in the camp-fire theory. The Doctor, at the time and since, has earnestly advocated the theory that the phenomenon was the result of a volcano in active operation.

Dr. J. B. Trask also states that at about the same period he was near Rich Bar, on the north fork of the Feather River. He, too, distinctly remembers the display for many nights in succession. From his point of observation the distance cannot be more than forty miles to the cone.

Mr. Charles Gibbes stated that he and a party of miners witnessed the same spectacle while at Angel's Camp, and referred it to an eruption of a volcano. Himself and comrades, in their estimate of the distance to the supposed volcano, placed it at 150 miles; in point of fact, it is about 160.

Mr. Henry Chapman, a member of the Academy, writes that during the

summer of 1851 he resided for a short period at a wayside hotel near Georgetown, El Dorado County. One evening two prospectors arrived at the hotel, who stated that they had been since early spring in search of the mythical gold lake. They informed the company that they had traveled toward the north for a distance of more than two hundred miles without discovering gold. They stated that they had, however, discovered a boiling lake and a volcanic mountain, which "threw up fire to a terrible height," and a large breadth of country still on fire, as the result of an eruption. They stated further, that at one point they traveled for a distance of ten miles across a strip of country where the rocks were still so hot as to entirely destroy their boots, they losing a horse and one mule during the transit. They placed the location of the mountain at an estimated distance of 100 to 125 miles in a northerly direction from Georgetown. By referring to the new geological map of the State, it will be seen that the distance from Georgetown to the Cinder Cone I refer to is about 115 miles. If this statement can be relied upon, the burning country they mention must have been the belt of hot ashes which I have described.

The boiling lake referred to is doubtless one which is still in existence, it being located about eight miles to the south of the Cinder Cone.

It is oval in shape, and contains an area of a little more than four acres, with an elevation of 5,976 feet, and is surrounded by hills of 100 feet in height, broken only at one point by a fissure which admits the escape of surplus water. Around the borders of this lake I found a large number of mud cones, from one foot to four feet in height, formed of finely pulverized volcanic rock. These miniature craters were in a state of ceaseless activity, ejecting mud and sulphurous vapors.

The water of the lake itself was hot, of a creamy color, and the surface from time to time disturbed by the escape of gases from the earth beneath.

My guide informed me that the lake is much more tranquil than at the period when he first beheld it, ten or twelve years since; and, indeed, there exists abundant evidence to prove that this district is rapidly cooling. A mile or so to the south of the lake there is a geyser ejecting boiling water to the height of ten feet, and Field assured me that in former times the water was elevated to a height of twenty or twenty-five feet. While three or four miles to the westward there exists a huge geyser cañon with hundreds of springs still in action, yet there are many large cauldrons which have ceased action altogether.

S. C. Hartney read a communication, in the form of a memorial to the trustees of the Lick Estate, relative to the terms of the "Lick Donation," and asking for a modification of said terms.

Dr. Dall moved that the memorial be referred to the Trustees, with power to act. Mr. Dameron moved to amend this by appointing a committee of three to act with the Trustees. The amendment was carried, and the Chair appointed as such committee, S. C. Hastings, R. C. Harrison, and J. H. Smythe.

Pacific Coast Lepidoptera, No. 9.—Description of a New Species of Thyris, from the Collection of Dr. Hermann Behr.

BY HENRY EDWARDS.

Through the kindness of my friend Dr. H. Behr, I am enabled to present the following description of a new species of this very interesting group of insects, examples of which are contained in his collection.

The genus *Thyris*, though of wide geographical distribution, contains but few forms, and perhaps not more than five species are yet known to science. Of these, two are found in Europe, one in India, and two in the United States. The species now noted approaches very closely in coloration to the European forms, but is in many respects abundantly distinct.

Thyris montana. Hy. Edw. n. sp.

Head and thorax, light brown, with yellow reflection. Antennæ, palpi, and tongue, chestnut. Abdomen, yellowish brown, very glossy.

Primaries, tawny, palest at their base, with four waved brownish bands, the two basal narrow and very irregular in form, third broadest, notched inwardly, and spreading out to its greatest width on costa, where it incloses a small triangular yellow patch. Submarginal band, almost equal. On the disc is a minute, subovate, vitreous spot. Fringes, yellowish brown.

Secondaries, tawny, with brownish blotches. In center of the wing is a large vitreous patch, seemingly two oblong patches joined together. Fringes, yellowish brown. Underside, same as the upper, with the brown markings a little darker and the vitreous patches less distinct. Size of *T. lugubris*.

Rocky Mountains, Colorado. Two ♂ in collection of Dr. H. Behr.

Nearly allied to *T. fenestrata* of Europe, but differing by its paler color, and by the smaller size of the vitreous spots.

Specimens of *Thyris maculata*, Harris, are also to be found in Dr. Behr's collection, taken in the same locality as *T. montana*.

Lake Livingstone.

BY H. W. HARKNESS, M. D.

This lake, which has previously been visited only by a few hunters, is situated in the midst of mountains of high altitude, which flank Warner's Valley upon the north and Big Meadows upon the west. In general outline the lake is in the form of a triangle measuring one and three-fourths miles in its two greatest diameters. The barometer marked an altitude of 7,330 feet above the sea level, it being, as I believe, the most elevated of any body of water of such magnitude in the United States, although there are many lakes in the vicinity of a much greater elevation, but of less extent.

I failed to detect the least trace of fish, or, indeed, of any animal life what-

ever, except upon the northern shore, where in a sheltered inlet I discovered a colony of red cyclops.

The water in August was intensely cold, of a bright green color near the shore line, and a deep blue at a little distance from it.

Mountains of volcanic origin rise somewhat abruptly from the water, yet one may make the circuit of the lake without any difficulty, upon horseback.

The surplus water escapes from the southern extremity into Warner Valley over a sharp declivity of, I should say, more than two thousand feet. At this outlet I discovered specimens of *Spirogyra* and several other varieties of fresh-water *Algæ*. As this lake was comparatively unknown and without name, I gave it that of Livingstone.

On motion of Mr. Brooks, it was resolved that the lake in Plumas County described by Dr. Harkness be called "Lake Harkness" instead of "Lake Livingstone."

Regular Meeting, November 16th, 1874.

Vice President in the Chair.

Thirty-five members present.

Donations to the Museum: Wm. J. Fisher presented a collection of *Crustacea* from Japan and Sandwich Islands. Bradley & Rulofson presented photographs of Indian skulls. F. R. Cassel presented two fish (*Chaetodon*). W. C. Reiten, of Pittsburgh, Pa., donated a case containing a specimen of summer duck (*Anas sponsa*). W. G. Blunt presented a specimen of "Foolish Guillemot" (*Uria lomvia*). Dr. Harkness presented specimens of volcanic ash from the recent volcano in Plumas County, California. Charles P. Kimball donated two slates, on the surface of each of which a fungus (*Penicillium*) had grown, having the appearance of a delicate tracery.

Dr. J. G. Cooper stated that the bird presented by Mr. Blunt, called "Foolish Guillemot" (*Uria lomvia*) by the whalers, was the first of the kind obtained on the California coast. It is common in the Arctic Ocean, and the far north Atlantic, and has been doubt-

less driven so far south by unusually cold weather. He also stated that Mr. Gruber has lately obtained here the first California specimen of the "Arctic Skua," (*Stercorarius parasiticus*) another evidence of severe weather approaching. The interior papers, about two months since, noticed also the uncommonly early arrival of the wild geese from the north. The unusual amount of rain already fallen is an evidence of cold weather northward, though we have not felt it here, as the upper current of cold north winds condenses the moisture brought to us by the warm south winds. These facts should be recorded, and we may find the "Foolish" Guillemot really a very weatherwise bird.

Description of a New Species of Shell from San Francisco Bay.

BY DR. W. NEWCOMB.

Mya Hemphillii.

Shell, oblong, nearly equivalve, moderately gaping at each extremity, thin, opaque or translucent, white, with margin covered with a light yellow epidermis. Valves, rounded anteriorly, cuneate posteriorly, finely striate transversely and longitudinally, near the extremities becoming coarsely striate; obsoletely transversely rayed with an opaque white. Umbones small, depressed, approximate; hinge-line, arcuate. Left valve, with a spoon-shaped tooth, posteriorly bifid; right valve, excavated for insertion of the ligament, and furnished with a small rudimentary tooth in close apposition with the ligament.

Length, 2 1-10 inch.
Breadth, 1 3-10 inch.
Depth, ¾ inch.
Hab., Bay of San Francisco.

REMARKS.—This shell was discovered by H. Hemphill, Esq., to whom the scientific world is greatly indebted for his extensive researches on our coast and in the interior of our country. The only species with which it can be confounded is the *Mya præcisa* of Gould, which Dr. Carpenter considers as identical with *M. truncata* of the Northern Atlantic.

A specimen of *M. arenaria*, from Puget Sound, in my collection, is quite distinct from this species, and, like many of the circumpolar species, is common to the North Pacific and North Atlantic.

It is quite distinct from the fossil *M. Montereyi*, Conrad, as I am informed by Dr. Cooper, who kindly made for me the comparison of this shell with Conrad's figure and description.

On the Composition of some of the Grapes grown in California, in relation to their Fitness for making Wine.

BY JAMES BLAKE, M. D.

Having while in El Dorado County tasted some wine which evidently was superior to anything I had before tasted as the production of our State, I inquired of the maker the variety of grape from which it was produced, and found that it had been made principally from a grape known in this country as the Zinfindel. Since my return I have made an analysis of the juice of this grape, and also of some others, which are now being propagated for making wine. The grapes were grown at the vineyard of the Vinicultural Society at Sonoma, and were all apparently perfectly ripe. The varieties analyzed, besides the Zinfindel, were the Reimer, a large white grape, the Riessling, also a white grape, and the Mission grape. The method of analysis was to take a portion of the juice, heat it, to coagulate the albuminous matter, filter through a Bunsen filter, and after bringing the juice to the original quantity, to neutralize with a standard solution of potash or ammonia, so as to ascertain the total amount of free acid. Another portion of the juice was evaporated to about one-third, mixed with alcohol and ether, to precipitate the tartrates, and the alcohol and ether distilled off from the filtered juice, which was then neutralized, to ascertain the amount of free acid. The amount of sugar, as indicated by the sp. gr., was controlled by direct analysis of a portion of the juice, cleared by acetate of lead, by means of Fehling's copper test, and the result thus obtained is that recorded:

	Sp. Gr.	Sugar.	Free Acid.	Malic Acid.
Zinfindel	1072	16.6	1.73	0.60
Reissling	1083	18.7	1.10	0.57
Reimer	1057	14.0	1.30	0.80
Mission	1088	21.5	0.60	0.11

As there can be but little doubt that the development of the ethereal substance, on which the aroma of wine depends, is owing to the presence of free acid, and more particularly, I believe, of free malic acid, the above figures explain the cause of the absence of aroma from the wine made from the juice of the Mission grape; for while the three varieties of foreign grapes analyzed contain respectively 60, 57, and 80 parts of malic acid to 10,000 parts of juice, the Mission grape contains but 11 parts. The presence of this comparatively large portion of malic acid in grape juice is a fact which has not, I think, received the attention it deserves. I believe the acid itself splits up into an ether and an alcohol, and this independently of its action on the alcohol already found in the wine. Wislicenus has shown that lactic acid forms an ether, even when being dried at ordinary temperatures, over sulphuric acid, and alcohol is one of the products of the fermentation of malic acid. There would seem to be enough potash in the grape juice to form, with the tartaric acid, the slightly soluble bitartrate of potash, as after this has been precipitated by alcohol and

ether, and the juice then nearly neutralized with potash, no more bitartrate is thrown down by again mixing the juice with alcohol and ether, but malate of potash separates as a thick, syrupy deposit.

These figures, as far as they go, give, I think, a satisfactory explanation of the superiority of the Zinfindel as a wine-producing grape, and fully bear out the conclusions I expressed some fourteen years ago in a report I drew up as one of a committee for examining the wines at the Agricultural State Fair at Sacramento, in 1860. As these remarks contain suggestions which, I think, will be useful to our wine-growers, I shall offer no apology for quoting them. After pointing out the great advantages, as regards climate and soil, found in our State for cultivating the grape, and which, I believe, insure its being the finest wine-producing country in the world, I remarked on the imperfect manner in which these advantages had been utilized by our wine-growers, as indicated by the quality of the wines exhibited, and pointed out what I then considered to be the cause of our want of success, observing: "In view of these facts, your Committee believe that they are authorized to call the serious attention of our wine-growers to the necessity of an early introduction into this country of varieties of foreign grapes, which appear to possess those qualities which are wanting in our own, or in other words, which contain less sugar and more free acid." After mentioning some of the varieties of European wine grapes which possessed these qualities, I remarked: "It is highly probable that the grape now cultivated in this State is about the worst that could be selected for making a first-class wine." The truth of this remark is now being realized by our wine-growers, who are replacing as fast as possible the Mission grape by foreign varieties; for it is found that even where a portion of these foreign grapes are used in the manufacture of the wine, it commands a much higher price than that made with the Mission grape. I believe that either of the foreign varieties which I analyzed is capable of making a good wine when the soil and climate to which it is most suited are properly selected.

Of the necessity of paying some attention to the selection of the variety best suited to the very marked varieties of our soil and climate, I quoted the following remarks of Mr. Rendu, Inspector General of Agriculture in France, and author of a work on the vineyards of that country. After describing 144 varieties of grape that are grown for making wine, he says: "Almost every variety of soil is found in our more celebrated vineyards, and appears able to furnish a superior wine when the variety of grape cultivated has been well selected, that is, when it is perfectly appropriate to the soil and climate. The choice of the proper variety of grape that will suit the soil and climate is, after all, the great secret for obtaining superior wines in a climate where the grape flourishes." That so little success has, up to the present time, attended the efforts of our wine-growers to produce a first-class wine, is not surprising, when we consider that not only have they been working with probably the worst grape for the production of such a wine, but have been endeavoring to make the same grape produce good wine in the moist alluvial soil of Los

Angeles and in the heated volcanic hills of the Sierras.* A long experience, however, will be required to discover the most appropriate varieties of grape suited to our varied conditions of soil and climate.

As showing the influence of soil and climate on the qualities of the grape, it is interesting to compare the analysis of the same variety of grape when grown in Germany with those grown here. In Watts' chemical dictionary I find an analysis of the juice of the Riessling, made in Germany, by Fresenius. The quantity of sugar is there given as 15 per cent., and of free acid as 0.53 per cent., while here the juice contains 18 per cent. of sugar and 1.10 of free acid; or three per cent. more sugar and twice as much free acid. Should the presence of the free acid influence the quality of the wine in the manner I have pointed out, it is evident that the Riessling may make a superior wine here to that made from it in Germany, that is, when grown in the localities which suit it.

On a New Species of Alcyonoid Polyp.

BY WILLIAM J. FISHER.

Genus: *Virgularia.* Lamarck.

Virgularia ornata, Fisher, n. sp.

Axis cylindric, slender, calcareous, smooth, and of a bright orange color.

Polyps arranged generally in disconnected groups of seven, but sometimes in clusters of six and eight, and following the axis spirally.

The groups occupy alternate positions upon the polypidom, as will be seen when the latter is viewed in profile, and they are not always equidistant one from another.

Polypidom of a faint flesh color, slightly enlarged in central portion, and gradually tapering towards either end. Above the termination of the axis—which is falciform and naked at its lower extremity—the polypidom assumes an elongated bulbous form, gradually decreasing above to a size not much larger than the axis, until it meets the undeveloped polyp group.

Length of axis, 4.30 inch.

Entire length of polypidom, 3.40 inch.

Length of bulbous portion from base to where polyp-rows commence, 0.65 inch.

Length of portion occupied by polyp-rows, 2.75 inch; but the polyps are most conspicuous on the upper half of polypidom.

These polyps were dredged by me in Hakodade Bay, Japan, in seven fathoms, muddy bottom, and were only obtained in one single cast, although I dredged the bay very thoroughly.

In conclusion, I would express my sincere thanks to Dr. Harkness for his valuable assistance in the microscopical examination of the above species.

* I would observe that the Zinfindel, from which the wine I tasted was made, was grown near Coloma, and I believe on a soil of decomposed granite.

The Eocene Epoch in California.—Are there Really no Eocene Strata?

BY DR. J. G. COOPER.

In describing the miocene formations of California, I made the remark that no positively eocene fossils had been found here, either marine or terrestrial, indicating a wide gap in the early tertiary age. Two explanations of this have been suggested. One is, that the land embraced in our limits was entirely above the ocean during that epoch, so that no marine deposits could be formed on it. But, if so, the land must have been so extensive that it would almost certainly have had a fauna and flora, like those so richly stored up in the Rocky Mountain eocene, and traces of them would surely be found fossil.

The second theory is, that the present dry land was then sunk so deep beneath the ocean that such marine animals as live near the shores, and have furnished most of the fossils in other formations, could not exist, or that the rapid sinking of the rich cretaceous shores caused so rapid a deposit of sand and mud to accumulate, that marine animals could not flourish. There is some proof that this might have been the case, in the fact that we find great thicknesses of shales and sandstones, above the so-called cretaceous fossils, with no fossils in them except obscure marks, like tracks or burrows of marine worms and casts of seaweeds. If sunk very deep, we should find, however, some of the chalk-forming protozoa, still living in the bed of the Atlantic, which are so abundant in the Old World.

Another cause for scarcity of organic life in these beds is suggested in the greater prevalence of volcanic action on the shores of the Pacific than of the Atlantic, by which, during periods of rapid subsidence, the water was probably heated or poisoned through vast extents of the ocean.

I have before stated the evidence to show that, during the miocene and pliocene epochs, California was constantly rising above the sea, and we have evidence also that this rise was commenced in the cretaceous, from the existence of coal-beds referred to that age, in the strata adjoining to which we find fossil land-plants, and trunks of trees. But as the cretaceous elsewhere was an age of almost general subsidence of the continents, we might rather suppose that after the burying of these coal-beds beneath strata of marine formation, the land would rise still more extensively than before, and, as in Europe, we would have a grand terrestrial eocene fauna, with comparatively narrow deposits of marine fossils along its shores. We find, however, that the old geological divisions of time, founded on studies in Europe, are still less applicable here than in the Atlantic States, and there is reason to suspect that while the great and complete change from the cretaceous to the tertiary ages was occurring there, this Coast was undergoing a very gradual transmutation, with only partial extinction of the cretaceous life, or an evolution of the tertiary therefrom.

The evidence is so far derived from only a few marine fossils which have been referred by different authors to the cretaceous, the eocene, and the miocene.

Conrad, the Nestor of American palæontologists, over twenty years ago, described as unmistakably eocene, a group of fossils, now known as the Tejon group, among which he thought was the *Cardita planicosta*, "that finger-post of the eocene, both in Europe and America." Mr. Gabb, finding from better specimens that this shell differed from *Cardita planicosta*, described it as new, and referred the Tejon group to the cretaceous, finding in it a very few species which he considered identical with the lower beds, proved to be cretaceous by the presence of numerous ammonites. He also stated, in an article in our Proceedings, published November, 1866, that "a solitary ammonite, represented by half a dozen specimens, has been found by myself *in place*, even to the very top of the formation." This slender evidence (which might be rejected after finding a carboniferous fossil in a pliocene deposit) is all the proof we have of the Tejon beds being cretaceous; and that it is quite arbitrary is shown by the other fossils found with it being nearly all different from the lower ones, less than one-tenth of the cretaceous shells being common to both according to Gabb, of which several *may be* distinct. On the other hand, many of the Tejon group are scarcely distinguishable from tertiary and living forms. One, *Aturia Mathewsonii*, is so near the eocene *A. zigzag*, as to have been taken for it, no other cretaceous *Aturia* being known.

I may add that the ammonite (*A. jugalis*, Gabb) was found by me in a stratum just beneath the Mt. Diablo coal, and apparently on the same level as those from Clayton and "Curry's," found by Gabb, so that its existence above the coal, or in the Tejon group itself, is perhaps accidental. But, to pass by this doubtful era, we have still later strata, referred to the eocene by Conrad, near the mouth of the Columbia, where we would expect the first tertiary to rise near the surface, and this time the eocene *Aturia zigzag* again appears, though with a different group of shells. Mr. Gabb, while admitting that this time it is the true *zigzag*, is so opposed to recognizing any eocene here, that he calls the formation miocene! The general character of these fossils, of which there are several in the Academy's Museum, shows, however, that they are of a more tropical group than any of our miocene species, the *Aturia* itself being very similar to the *Nautili* now living in the tropics. Though perhaps mixed with miocene species among the broken rocks so numerous on the lower Columbia shores, it is most probable that true eocene strata exist there, and, as shown by the Academy's specimens, extend south nearly to California, where later strata cover them. From all we yet know, we may assume that the gap between the cretaceous and tertiary, so marked on the Atlantic shores, was bridged over in part by the existence here of the "Tejon Group," continuing cretaceous forms of mollusca down so as to be contemporaneous with the eocene epoch there, or the earlier part of it, just as we find the flora and fauna of Australia resembling forms fossil in the eocene formation of Europe, but continued to the present epoch. After, perhaps, a short geological period of convulsions and death, we find the eocene mollusca appearing in Oregon, just preceding the miocene, nearly like those of the Atlantic basin.

Though I cannot speak positively on the subject, my impression is that the

plants found fossile in our coal measures are of a more temperate group than those of the cretaceous coal beds of Vancouver Island, which, if so, will be good evidence of their indicating a newer age.

Have the poles changed? 1. It will appear, from the preceding remarks, that it is not necessary to suppose a change of the poles to account for the absence of eocene fossils in California; but I still believe that the existence of tropical and temperate groups of beings within the Arctic circle, from the miocene back to the carboniferous age, proves either such a change, or the existence of some light-giving medium there in those ages, of which we have no knowledge. It is easy to account for a hot climate there, either by supposing the internal heat of the globe to have been greater, and the amount of radiation less, or by the existence of hotter regions of space through which the solar system was then traveling, but that alone could not produce the vegetation found there.

2. An increase in the obliquity of the earth's position in its orbit could only present each pole alternately to the sun, though more directly than now, so that, while each hemisphere would have six months of greater heat and constant light, they would also have six months of greater cold and darkness.

3. Juding from what we know, a vegetation so much like ours could not exist in a climate very different from ours, for we find entirely different vegetation in regions both north and south of us, having comparatively similar climates. A duration of day or night, for months, would be as great a change as one of many degrees of temperature. A four-months night, with warm climate, would either blanch or decay nearly all growth above ground.

4. The objection that the flattening of the poles proves a permanent position of the earth's axis, although now true, if the earth is nearly solid, need not have been so when it was semi-fluid in the interior, with a thinner crust. Even now, if the earth was to stop revolving, the water must run from the equator towards the poles, and cover them deeply enough to restore nearly the perfect spherical form, at the same time uncovering much of the land now submerged in the tropics. The flattest parts of the sphere would then be the deep bed of the ocean in or near the tropics. The difference between them and the summit of the Andes or Himalayas, is nearly as great as that between the convexities at the poles and the equator.

5. The objection that no cause is known that could produce a change in the earth's axis, is answered by the geological evidence of periodical changes in the elevation of the land, amounting to many thousand feet, which must, it seems, cause a change in the center of gravity of the earth, and a consequent shifting of its axis, not to mention the disturbing effect of the attraction of asteroids, etc.

6. Astronomical observations, extending back only about 4,000 years, may prove that no perceptible change has occurred since then, but cannot concern preceding ages. The earth's present oblique position is itself good evidence that the distribution of land and water has disturbed its axis from a position in which the equator would be always turned directly toward the sun, as in our semi-annual equinoxes.

REGULAR MEETING, DECEMBER 7th, 1874.

Vice President in the Chair.

Forty-seven members present.

Donations to the Museum: Dr. Hudson presented four fossils fron Grayson, Stanislaus County. Dr. J. G. Cooper presented specimens of *Crustacea* from Monterey. The Alaska Commercial Company presented a number of shells from Unalashka. W. G. Blunt presented a collection of eggs of California and European birds. Wm. Russell donated specimens of pyrites of iron, found in a piece of West Hartley coal. R. H. Floyd presented fossil bones found in an ancient river bed, 500 feet below the surface, in the blue gravel mines of Placer County.

J. R. Scowden and Horatio Stone were proposed as candidates for resident membership.

Note on Tertiary Formation of California.

BY J. G. COOPER, M. D.

Since making the remarks on the coal and tertiary formations of California, I have obtained the new edition (1874) of Dana's "Manual of Geology." The learned professor, acknowledged leader of American geologists, goes even further than I do in bringing down the age of our Mt. Diablo coal strata in the scale of geological time, for he considers them as belonging to the lignite era of the eocene, as well as that of the Rocky Mountains. Although in both cases there are some cretaceous fossils found in or above it, he considers the presence of lignite as more important, especially as showing the existence of a decidedly tertiary vegetation. He believes that the cretaceous mollusca continued down into the eocene epoch, there having been no important convulsion to destroy them until the middle of the eocene on this side of the continent. This is a confirmation of my statement that there is here a "bridging over" of the gap between the two formations so marked on the Atlantic shores.

Pacific Coast Lepidoptera, No. 10.—On a New Species of Papilio from California.

BY HENRY EDWARDS.

The species of *Papilio* composing the group of which *P. Asterias* and *P. zolicaon* are the best known forms, appear to have obtained their largest representation on the Pacific Coast, as the whole of those known to science, with the exception of *P. Bairdii*, from Texas, are found more or less abundantly from Alaska to the shores of the Gulf of California. That these insects are apt to run into varieties there can be but little doubt, and it has not been without some misgivings that I have ventured to add another to the list. I have, however, carefully studied all the examples in my collection, and can only arrive at the conclusion that I am justified in describing the following as a distinct species:

Papilio Pergamus. Hy. Edw. nov. sp.

♂. Antennæ and head dull black. Thorax, black, with the patagiæ rather dark yellow, orange anteriorly. Abdomen black, with a yellow lateral stripe, becoming obsolete towards the base. Feet and legs entirely black.

Primaries. Rich velvety black, as in *Asterias.* A row of eight cream-yellow sub-marginal spots, of which the one nearest the apex is the largest, and almost round. The second is also nearly round, the remainder becoming somewhat lunate, the last produced into a point posteriorly. The macular band is composed of eight spots, the smallest nearest the costa, and gradually increasing in width to the interior margin. The first spot is oblong, the next five are angular, the seventh is in the form of a parallelogram, and the eighth is a longitudinal streak. Within this band, and closely approaching the costa, is a small angular patch, and a very few yellow scales are visible in the middle of the discal cell, and near the base of the wing. Fringes black, with indistinct white patches between the nervules.

Secondaries. The macular band is wider than is usual in *Asterias*, and perfectly straight on its inner edge, so that when the wings are spread, the band of both wings presents a nearly uninterrupted straight line from the costal nervure of the primaries to the anal margin of the secondaries. The first two spots near the costal margin of secondaries are almost square, slightly notched exteriorly. The third is oblong, divided by the discal nervule. Spots four and five are somewhat angular, produced a little outwardly, thus destroying what would otherwise be a perfectly straight band. The sixth spot is almost a parallelogram, and the seventh is nearly lunate. The submarginal spots are five in number, the first near the costa a mere dot, the second almost oval, and the other three lunate. Margins of the wing broadly notched, emarginations yellow. Tails, wholly black, as long as in *Asterias*, but slightly narrower. Anal spot, large, black, with iris fulvous anteriorly, yellow posteriorly. Between the macular band and the submarginal spots are some bluish scales

becoming, as in all allied species, quite obsolete towards the costa, the most distinct being that which surmounts the anal ocellus.

Underside. Similar to the upper, except that the black is duller and less velvety, and the whole of the spots less yellow in color. The blue scales are more regularly defined, and approach the costa, where they are joined by the first submarginal spot, which is here bright fulvous.

Expanse of wings, 3.20 inch.

Length of abdomen, 1.25 inch.

This beautiful insect is closely allied to *P. Indra*, Reakt., but differs from that species by the greater width of the band of the secondaries, by the black anal ocellus simply surmounted with fulvous, and by the length of the tail, which, in *P. Indra*, is spoken of by both Messrs. Reakirt and Strecker as a mere tooth. In Mr. Strecker's drawing of the species, it is represented as shorter than that of *P. brevicauda*, whereas in the present species the tail is quite as long (though perhaps a little narrower) as that of *P. Asterias*. In a ♂ specimen of *P. Indra*, which I received from the high Sierra of Tuolumne County, there is also a decided yellow line on the outer edge of the discal cell, which is nowhere visible in *P. Pergamus*. The latter is also a little larger in size. I am indebted for this most interesting addition to our insect fauna to the late G. R. Crotch, who took one specimen in excellent condition near Santa Barbara, in May, 1873.

I am inclined to believe that *P. Aliaska*, Scud., is identical with *P. Hippocrates*, Feld., from Japan, as between some specimens of the latter in my cabinet, and one of *P. Aliaska*, taken by myself at the Dalles, Oregon, I can perceive no difference whatever. *P. Hippocrates* is stated by Kirby, and other European entomologists, to be only a variety of the European *P. Machon*. This appears to me to be an error, as in a long series of each the points of variation are quite easily distinguished, the shape of the lower wings being a permanent character. They appear to bear the same relation to each other as do *P. Turnus* and *P. Rutulus*. I have little doubt that *P. Astertoides*, Reakt., is the tropical form of *P. Asterias*, Cram.

The species may be thus tabulated :

A.

Macular band of secondaries extending to the base of the wing.

1. Band of primaries narrow on internal margin. Abdomen black, with yellow lateral line........................*P. Zolicaon.*
2. Band of primaries very wide on internal margin; abdomen yellow, with black dorsal line........................*P. Aliaska.*

B.

Macular band of secondaries narrow. Base of wing black.

a. Band bent inwardly on secondaries. Abdomen spotted.

1. Tails very short..*P. brevicauda.*

2. Tails long, band of secondaries narrow, fulvous beneath.....*P. Asterias.*
3. Tails moderate, band of secondaries broad, particularly at anterior margin; underside without fulvous spots....................*P. Bairdii*

b. Macular band perfectly straight on inner edge. Abdomen with yellow lateral line.

4. Tails very short.......................................*P. Indra.*
5. Tails long.....................................*P. Pergamus.*

I have derived the specific name from Virgil's "Æneid," thus translated by Dryden:

"With eager haste a rising town I frame,
Which from the Trojan Pergamus I name."

—*Æneid, Book III.*

S. C. Hastings read a paper on "The Coming Earthquake"; also one on small mounds of Pacific plains and valleys.

Regular Meeting, December 21st, 1874.

Vice President in the chair.

Thirty-two members present.

Jeremiah Clark was proposed as a candidate for resident membership.

Donations to the Museum: Specimens from the Sulphur Banks, Lake County, Cal. Case of alcoholic specimens from Alaska, from Dr. Jones. Three cases containing specimens taken in deep sea soundings from the U. S. steamer *Tuscarora*, presented by Admiral Rogers, by authority of Commodore Ammon, being the material collected by Wm. J. Fisher, of the *Tuscarora* expedition, under Commander Geo. E. Belknap.

A Device for the Solution of the Problem of Lengthening the Pendulum of an Astronomical Clock without Stopping or Disturbing its Vibrations.

BY T. J. LOWRY.

The mechanism of the astronomical clock, which has so greatly contributed to the accuracy as well of astronomical observations as of the determinations of longitudes, has been carried to a degree of wonderfully delicate perfection. Its correction for varying temperatures has been so complete, and its rate so uniform, that the astronomer has hitherto thought best to let it run without disturbing it by attempting to adjust the length of the pendulum, even though it was uniformly gaining or losing on the time it was desired to keep. Yet the very great inconvenience, to the practical astronomer in the observatory, of having his clock show a different face time from that given by the ephemeris, and the still greater reluctance to stopping his clock when once set going, have awakened the ingenuities of astronomers and artists to devise a means of lengthening and shortening the pendulum without disturbing its vibrations. And success had half crowned their efforts—by fixing a small funnel on the face of the pendulum and dropping small shot into it they succeeded well in shifting the center of gravity up towards the point of suspension, and thus shortened the pendulum without stopping or essentially disturbing its vibrations. But when they attempted to lengthen the pendulum, by extracting shot from the funnel, without disturbing its vibrations, they were baffled in their every effort. To drop the shot into the funnel was easy enough, but to get them out—that was the question. With a pair of ordinary tweezers and various other mechanical devices they attempted to lift out the shot, but these all disturbed the vibrations of the pendulum, and hence were inadequate. Seeing this difficulty, it occurred to me that if instead of using the small lead shots we used iron shots we could pick them up with a magnet: in fact, they will pick themselves up and jump to the magnet if it be held in close proximity to them. Of course, the magnet should be of small diameter and not very powerful, so as to avoid picking all the shot out at once, or essentially disturbing the vibration of the pendulum by its attraction. Thus, we see, gravity aids us in shortening the vibrating pendulum, and magnetism assists us in lengthening it.

This, I believe, will be found a solution of this problem, as effectual as it is simple.

The Nominating Committee appointed by the Council and Trustees in joint meeting, reported as follows:

The Nominating Committee appointed by the Council and Trustees of the California Academy of Sciences, to prepare a ticket for officers to act during the ensuing year, respectfully present to the members of the Academy the following names:

Trustees: David D. Colton, Thomas P. Madden, George E. Gray, John Hewston, Jr., Robert E. C. Stearns, Ralph C. Harrison, William Ashburner.

President, George Davidson; First Vice President, Henry Edwards; Second Vice President, Henry Gibbons, Sr.; Recording Secretary, Charles G. Yale; Corresponding Secretary, Henry G. Hanks; Treasurer, Elisha Brooks; Librarian, William J. Fisher; Director of Museum, Albert Kellogg.

H. F. CUTTER,
J. H. STEARNS,
[Signed] J. H. SMYTHE,
S. C. HASTINGS,
W. G. W. HARFORD.

The report was adopted and the Committee discharged.

On motion, Henry Chapman and J. H. Smythe were elected Judges of Election.

On motion, John Curry and J. D. Pierson, were elected Inspectors of Election.

INDEX OF AUTHORS.—1873-1874.

GENERAL INDEX.

ERRATA.

Page 58, seventh line from end of third paragraph, for " Voluti " read Voluta.

Page 112, twenty-first line from top of page, for " CTEUNCHA " read CTENUCHA.

Page 292, second line, for "*Jamaicaii*" read *Jamaicana*.

Page 292, third line, for " Tanajer " read Tanager.

Page 292, second paragraph, second line, for "*Avicenus*" read *Avicenia*.

Page 301, second paragraph, first line, for " Mussell " read Missell.

Page 301, second paragraph, third line, for "*Paraus*" read *Parus*.

Page 312, second line from bottom, for " Terrebratulina " read Terebratulina.

Page 324, second paragraph, fourth line, for " *musicans* " read *musicus*.

Page 324, second paragraph, sixth line, for " *Psitacula* " read *Psittacula*.

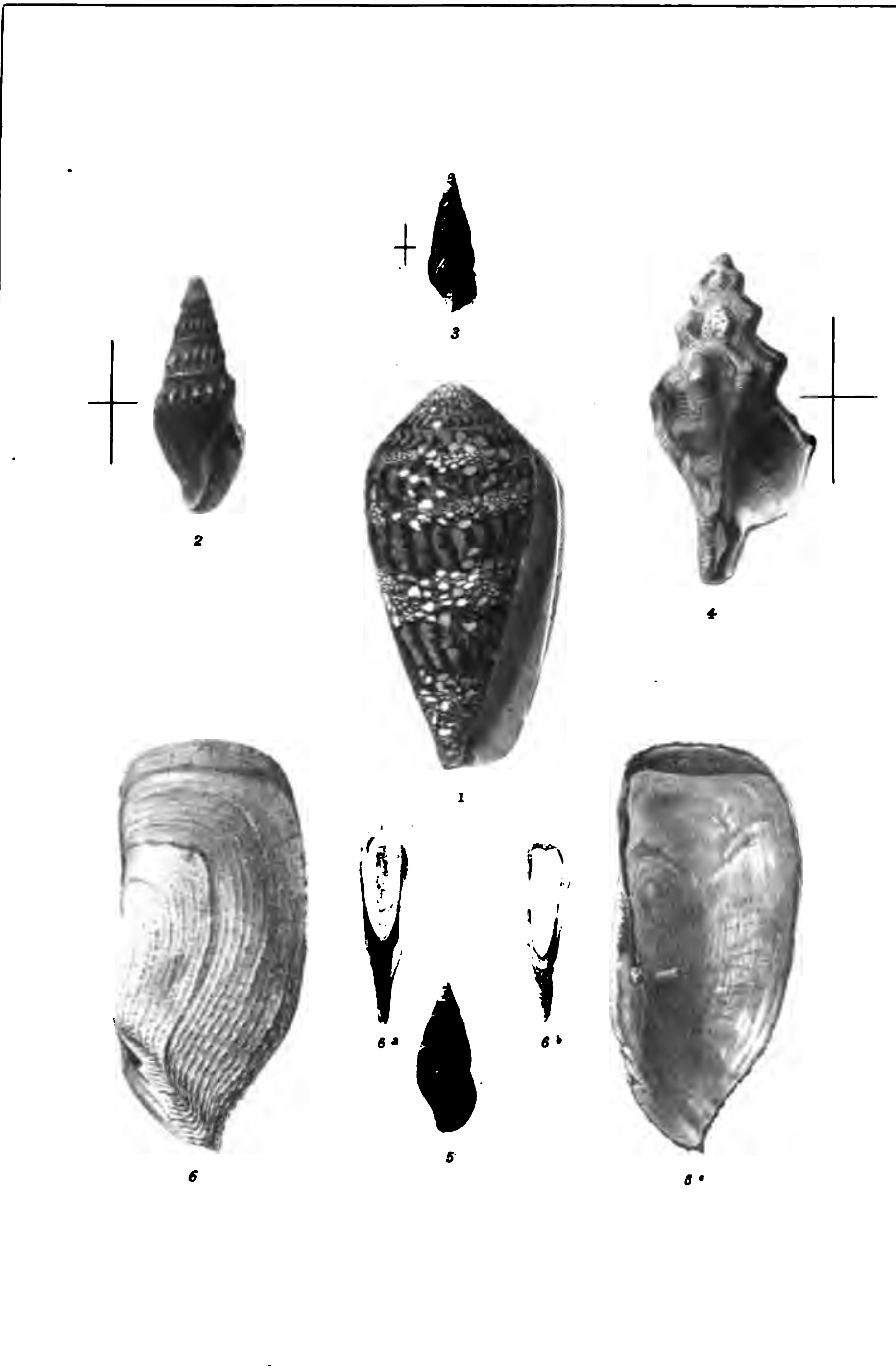
Page 324, second paragraph, seventh line, for "*Rhamphocilis*" read *Rhamphocelis*.

Page 338, sixth line, for " *Verillia* " read *Verrillia*.

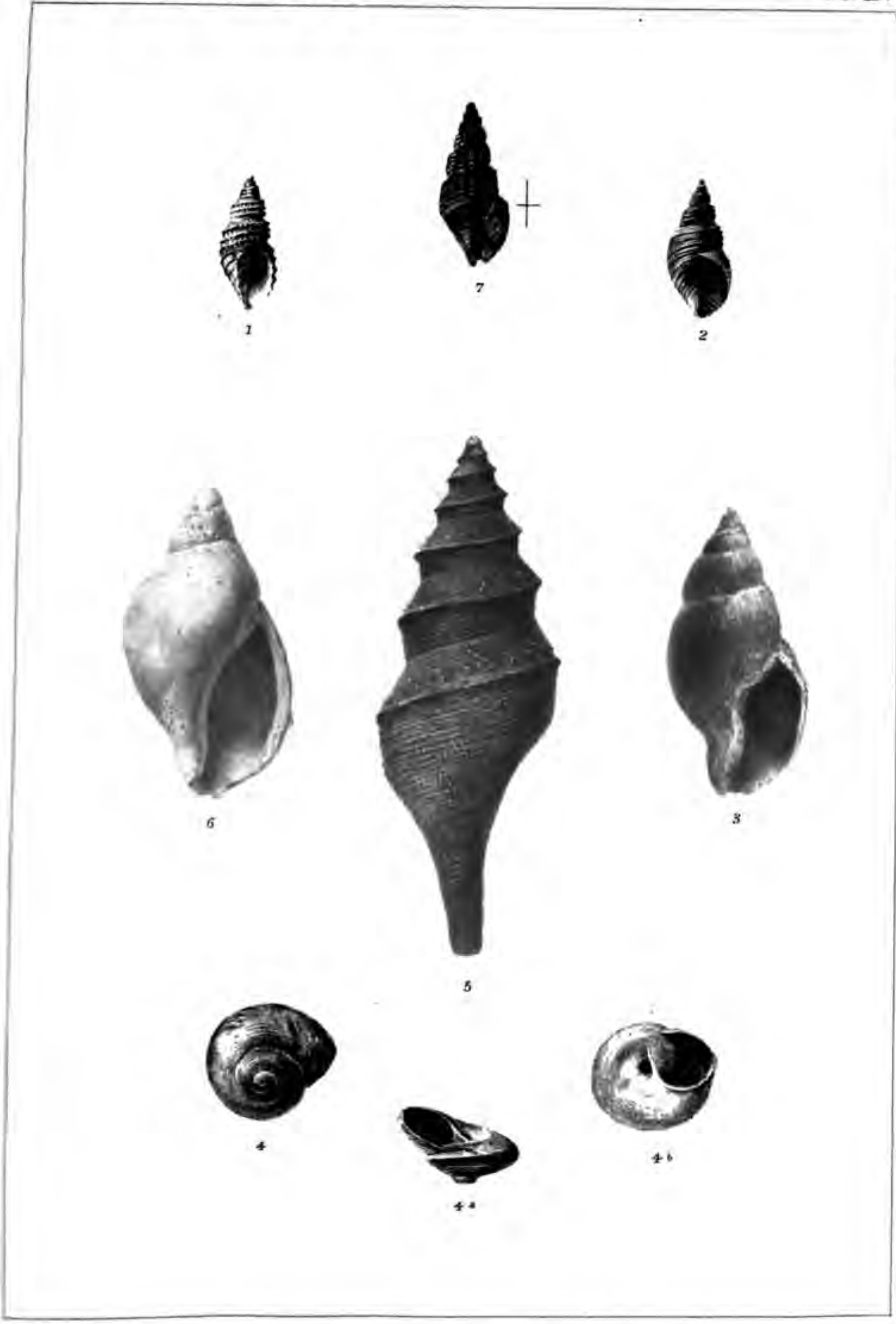
Page 338, fift. line from below, for "*eccentricus*" read *excentricus*.

Page 346, seventeenth line, for " *vomarina* " read *vomerina*.

Page 346, fourth line from below, for " *albiola* " read *albeola*.



NEW SHELLS OF THE WEST COAST OF N. AMERICA.



NEW MOLLUSKS FROM THE COAST OF ALASKA.

ANISEA AUREA, KELLOGG.

[SEE PAGE 83.]

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LILIUM BLOOMERIANUM V

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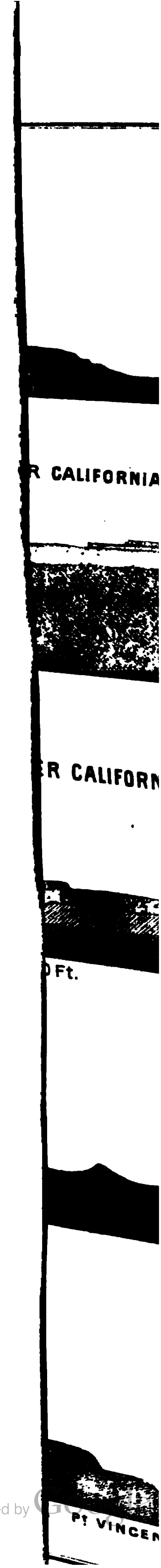
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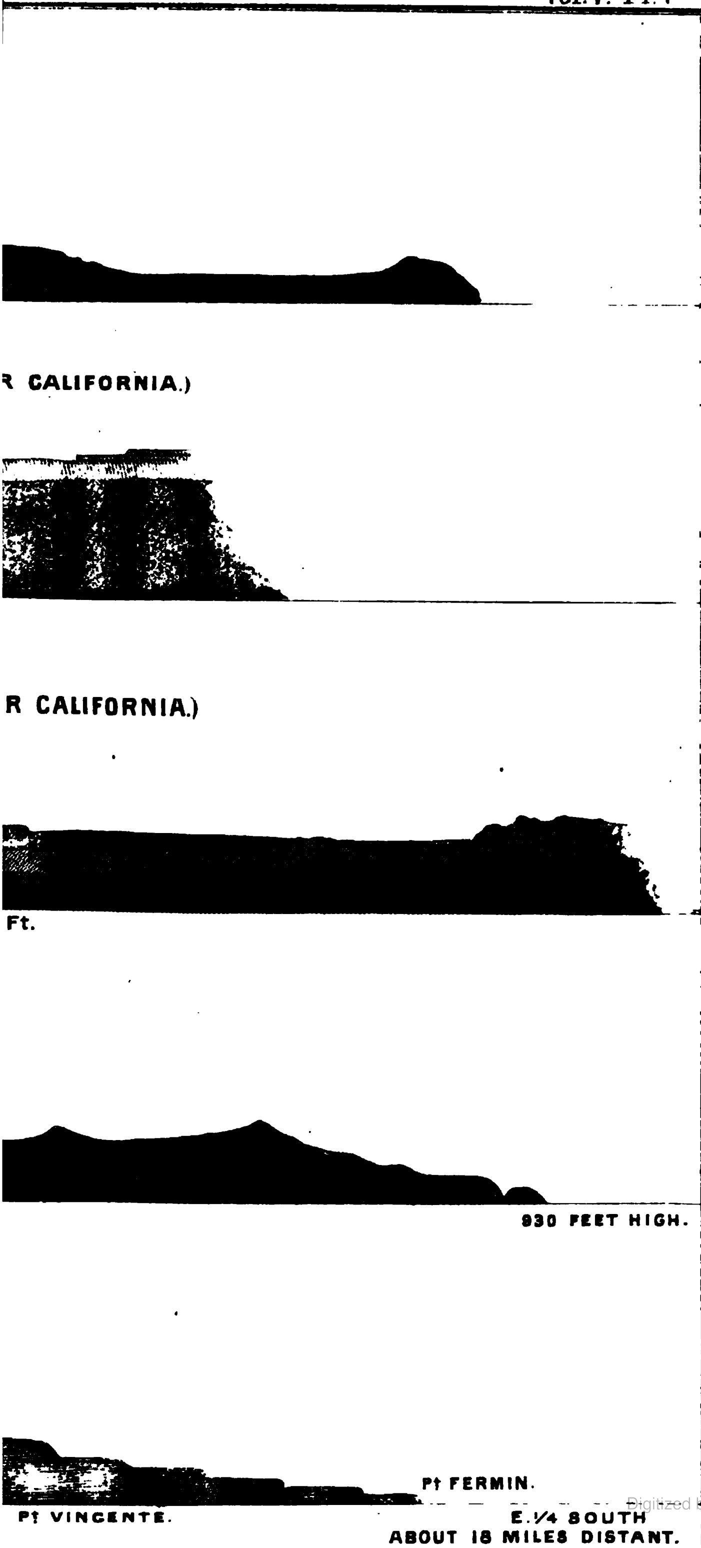
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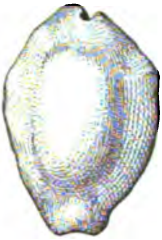

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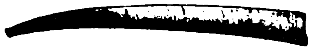

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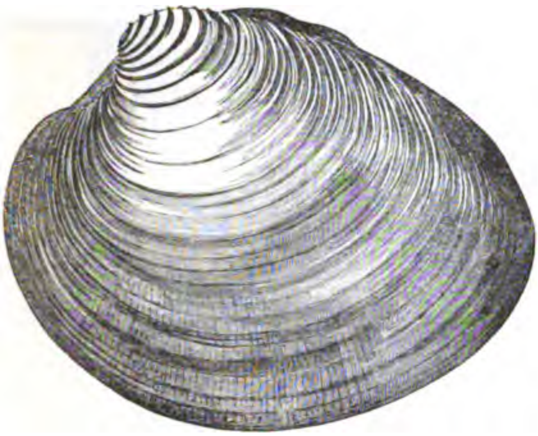

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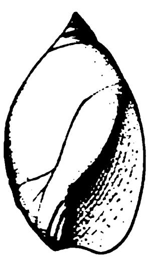

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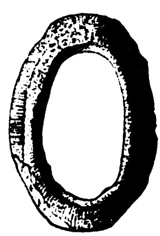

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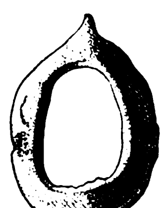

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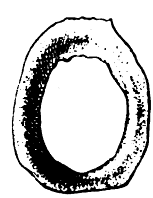

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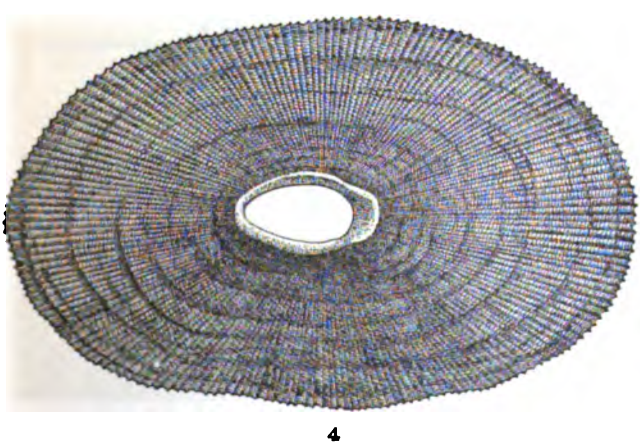
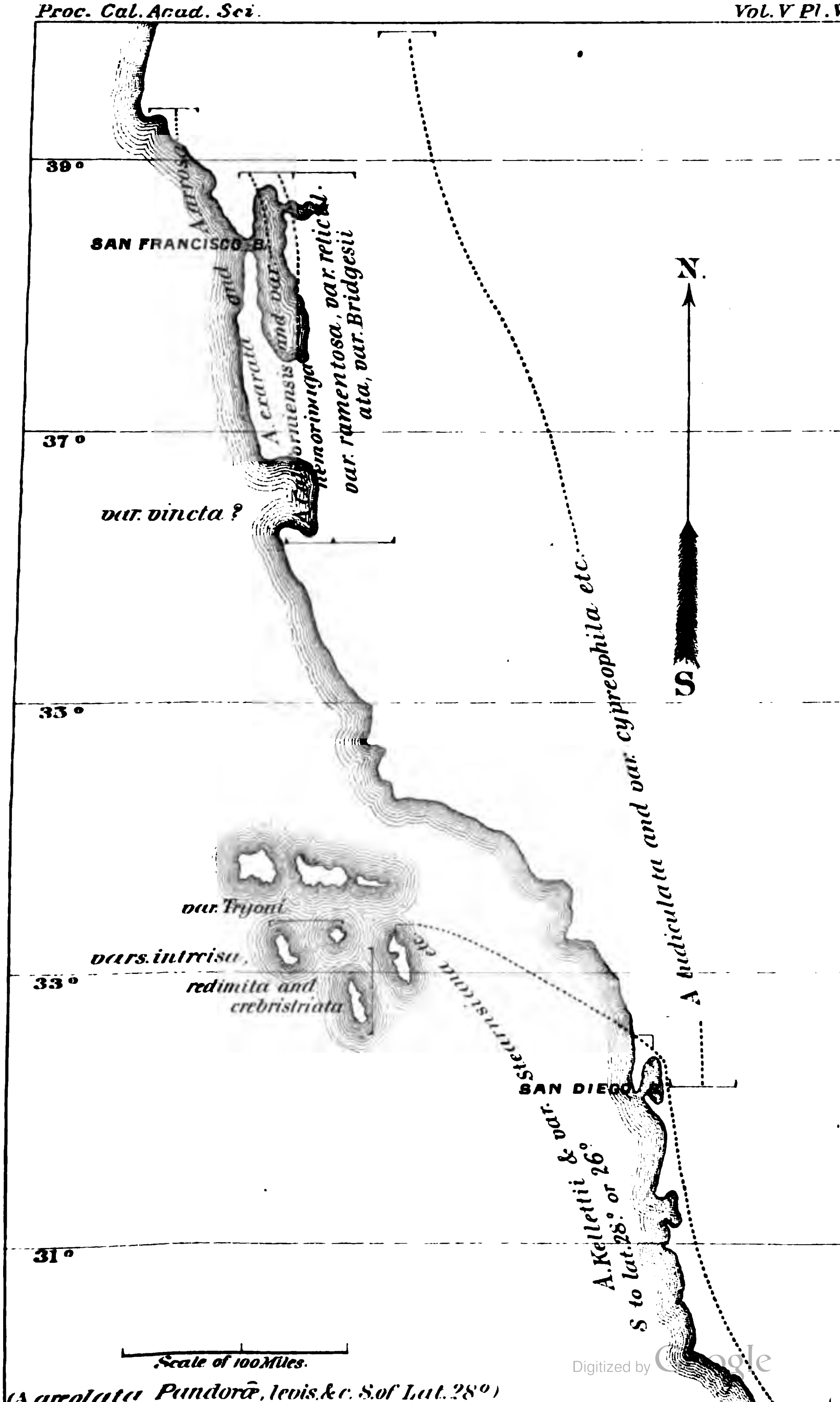


4

ABORIGINAL SHELL MONEY.

[SEE PAGE 113.]



J. G. Cooper del LITH. B.

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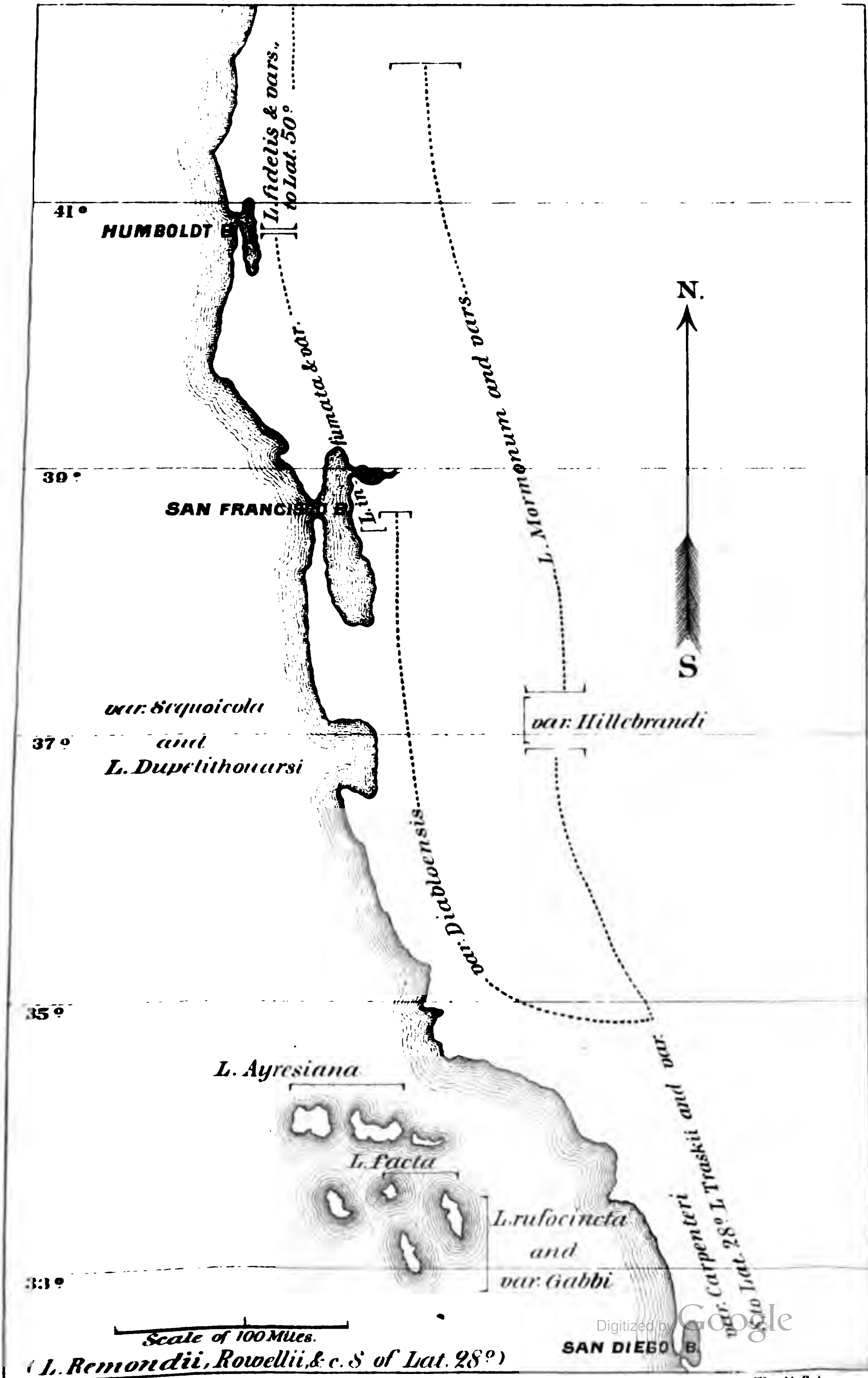

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Lith. B. & ?

DISTRIBUTION OF LYSINOE COOPER

INDEX TO PLATE IX.

Fig. 1.—Verrillia Blakei; Stearns. General aspect; one-twelfth natural size; from Dr. Blake's specimens.

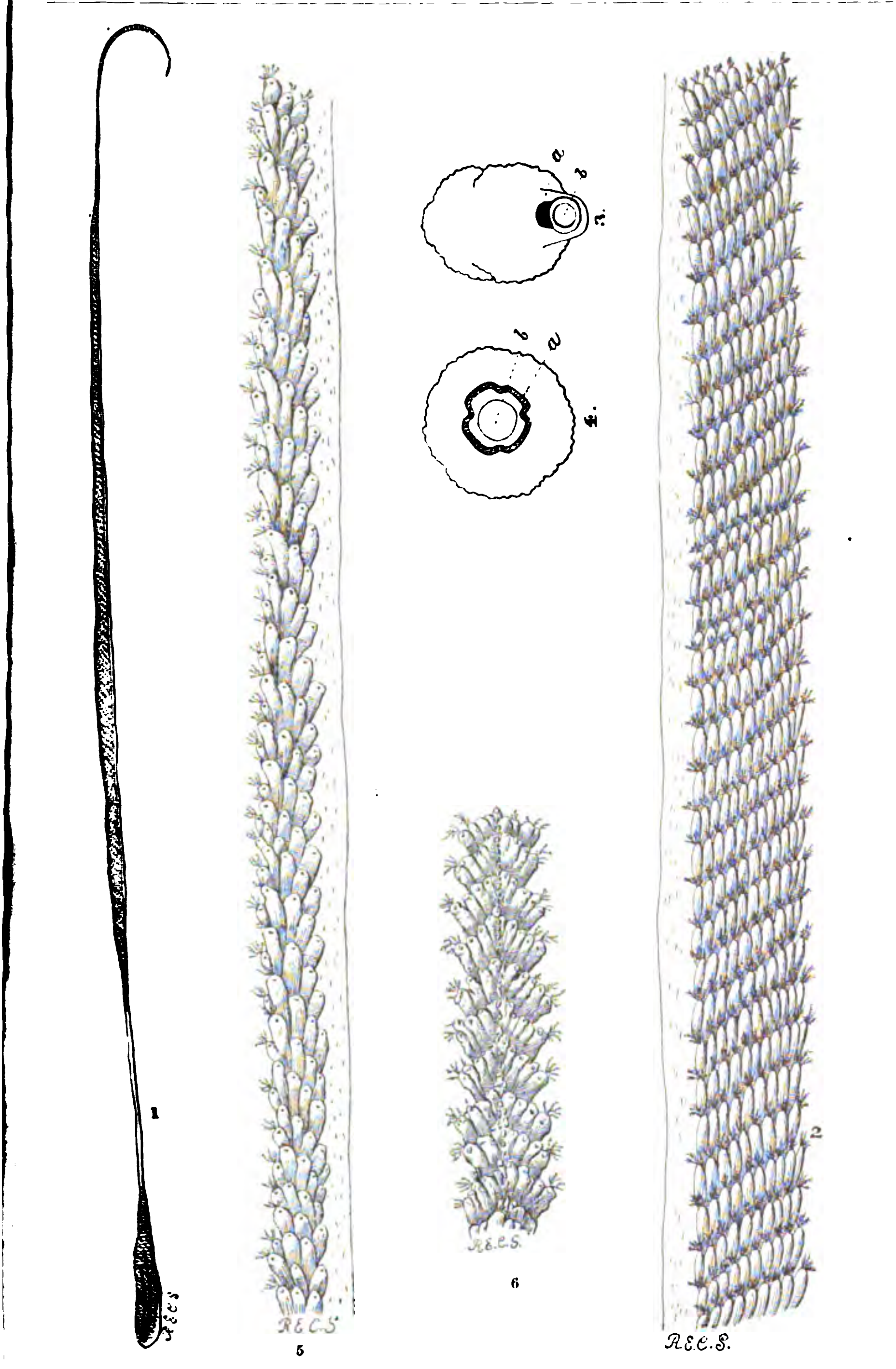
Fig. 2.—Section of Polypiferous portion of one of the largest and most crowded specimens. Natural size.

Fig. 3.—Cross-section through Polypiferous part; *a*, principal longitudinal canal; *b*, axis.

Fig. 4.—Cross-section through basal part; *a*, canal; *b*, axis.

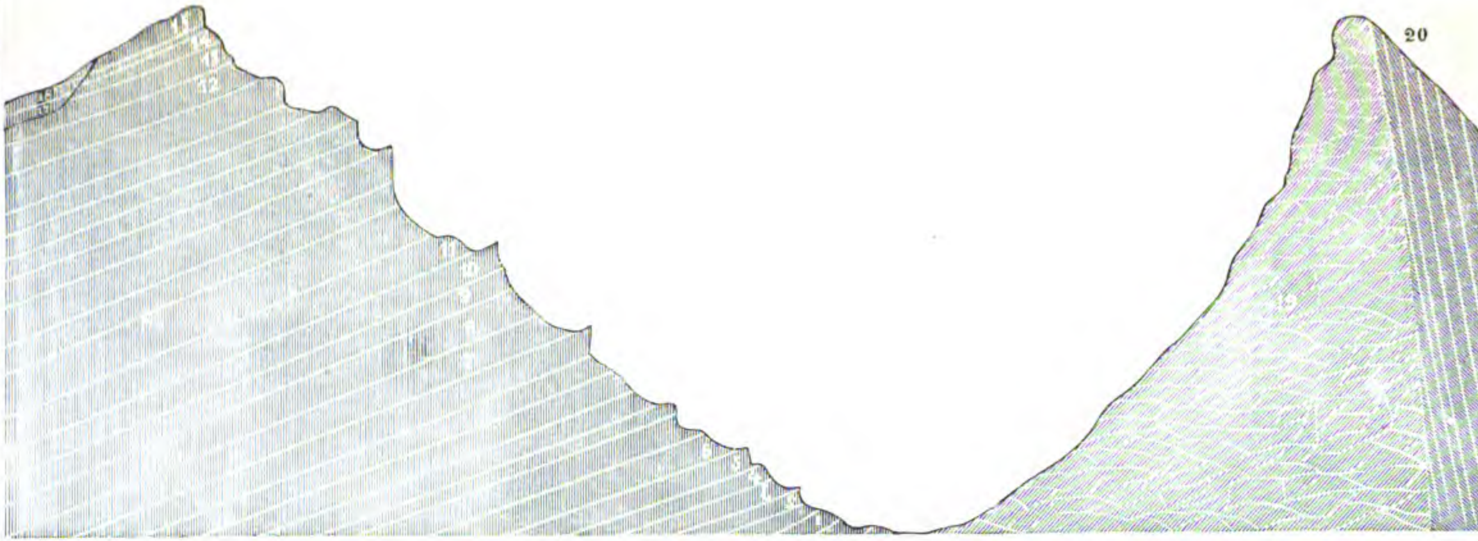
Fig. 5.—Section of Polypiferous portion of a smaller and less crowded specimen, received from J. S. Lawson, Esq. Natural size.

Fig. 6.—Section of above; (Fig. 5) showing chevron-like arrangement of Polyp-rows, opposite the axial-side. Natural size.



VERRILLIA BLAKEI, STEARNS.

[SEE PAGE 147.]



1 Anamesite.	5 Diabase.	9 Anamesite.	13 Anamesite.	17 Sedimentary Deposits.
2 Anamesite.	6 Anamesite.	10 Labrador Porphyry.	14 Porphyritic Obsidian.	18 Trachyte.
3 Anamesite.	7 Basalt.	11 Anamesite.	15 Vesicular Trachyte.	19 Porphyry.
4 Basalt.	8 Diabase.	12 Basalt.	16 Anamesite.	20 Schists.

The Plate represents only a plan of the order in which the different sorts of rock were found—beds of decomposed rock frequently separating the strata, indicated by consecutive numbers.

ON THE PUEBLA RANGE OF MOUNTAINS, BLAKE.

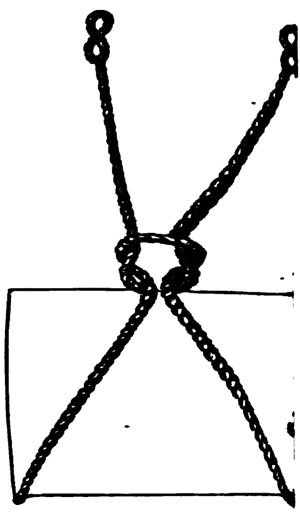
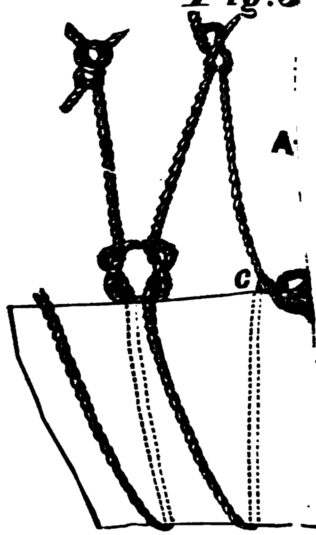


Fig.3



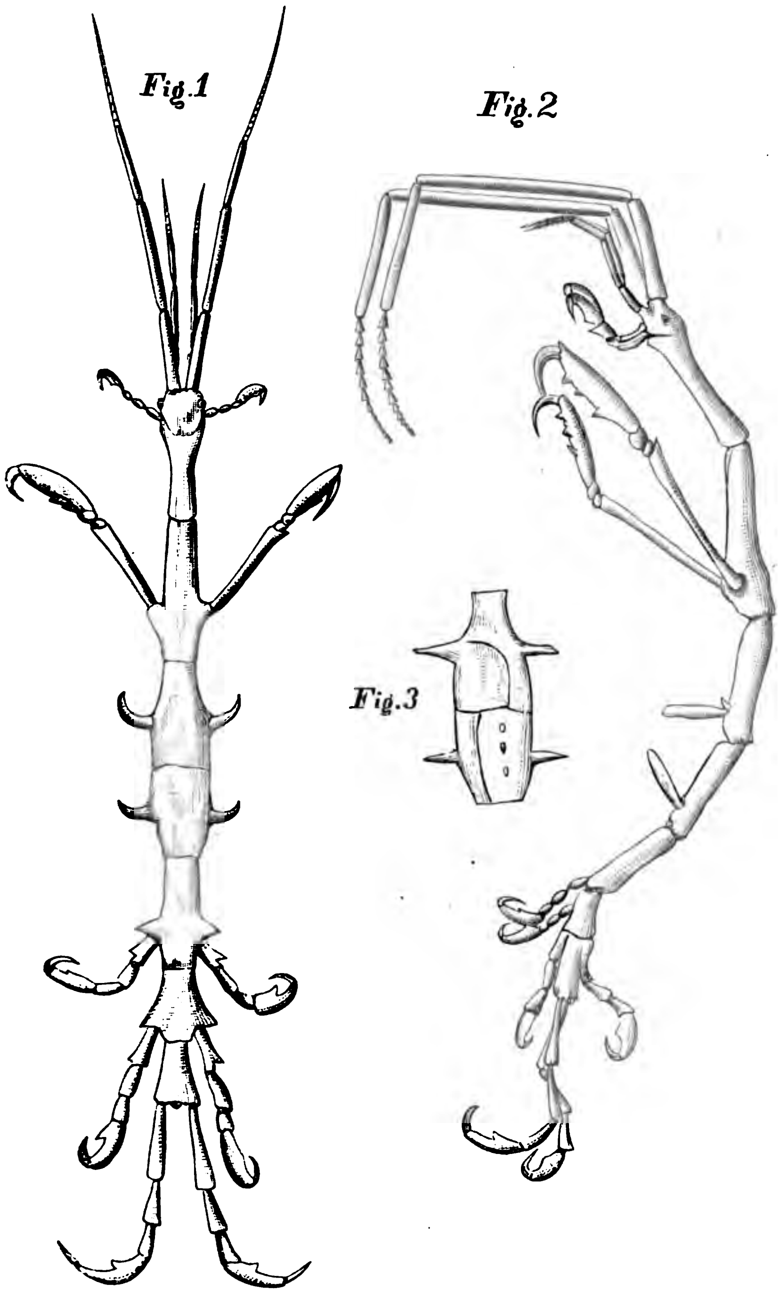


Fig. 1.—Female. **Fig. 2.**—Male. **Fig. 3.**—Ovigerous section, under third and fourth segments.

CAPRELLA SPINOSA, LOCKINGTON.

(SEE PAGE 404.)

FIG. 3.

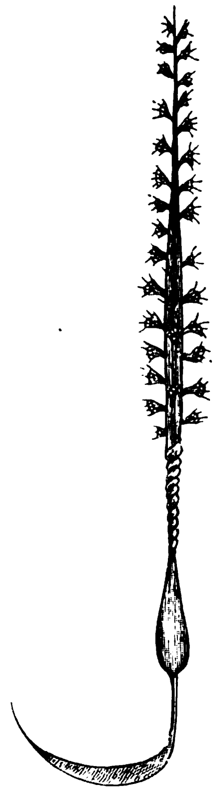


FIG. 1.

FIG. 2.

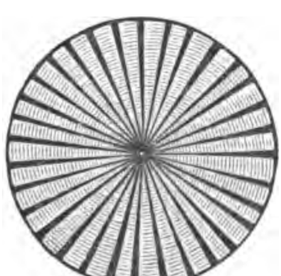


FIG. 4.

FIG. 5.

VIRGULARIA ORNATA, FISHER.

(SEE PAGE 418.)

INDEX TO PLATE XII.

Fig. 1.—Virgularia ornata, Fisher; general aspect; natural size.

Fig. 2.—Section of central portion of one of the largest and most developed specimens; enlarged ten times.

Fig. 3.—Section of central portion, viewed in profile; natural size.

Fig. 4.—Transverse section of axis; enlarged 600 times.

Fig. 5.—Transverse section of polypidom and axis; enlarged 250 times.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

ERRATA

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VOLUME VI.

1875.

SAN FRANCISCO.
1876.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

ANNUAL MEETING, JANUARY 4TH, 1875.

Vice-President Hewston in the chair.

Fifty members present.

In the absence of the President, the Vice-President read the annual address.

The Corresponding Secretary read his annual report, stating that the correspondence is becoming more extensive and important with the growth of the Academy.

The Recording Secretary submitted a brief report, giving the average attendance at meetings as 31 members, and the total resident membership as 301, and the life membership 78.

The Treasurer's annual report places the balance on hand at $2,958.43.

The Librarian's report gives the number of books in the library at 5,000 volumes, 2,500 of which are bound.

Dr. A. B. Stout, from the committee appointed to gather information sought by the French Acclimatization Society, reported that certain of the questions had been answered by different individuals. The report was accepted, and Dr. Stout was

requested to forward the material to Consul Breuil, for transmission to the Acclimatizing Society of France.

The reports of the Judges and Inspectors of election were received, signed by J. H. Smythe and Henry Chapman, Judges, and John Currey and J. D. Pierson, Inspectors. They reported the result of the annual election, as follows:

PRESIDENT.

GEORGE DAVIDSON.

FIRST VICE-PRESIDENT.
HENRY EDWARDS.

SECOND VICE-PRESIDENT.
HENRY GIBBONS, Sr.

CORRESPONDING SECRETARY.
HENRY G. HANKS.

RECORDING SECRETARY.
CHAS. G. YALE.

TREASURER.
ELISHA BROOKS.

LIBRARIAN.
Wm. J. FISHER.

DIRECTOR OF MUSEUM.

ALBERT KELLOGG.

TRUSTEES.

DAVID D. COLTON,
JOHN HEWSTON, Jr.,
ROBT. E. C. STEARNS,
GEO. E. GRAY,
RALPH C. HARRISON,
THOS. P. MADDEN,
WM. ASHBURNER.

Regular Meeting, January 18th, 1875.

Second Vice-President Henry Gibbons, Sr., in the chair.

Seventeen members present.

Donations to the Museum: The Alaska Commercial Company donated two Aleutian mummies, a complete description of which appeared in the *S. F. Chronicle*, of January 8th, 1874; Jesse

Walton donated specimen of *Liparis pulchellus* (?) or *mucosus*, Ayres; Mr. B. L. Savory, of Tuolumne County, presented, through Mr. Brooks, two specimens of pound pear, one picked from the tree October 1st, 1873, and the other fresh.

The Vice-President stated that General Cobb had signified his intention of depositing in the Museum of the Academy, the articles found in the shell mound at Saucelito.

Dr. Kellogg exhibited plants, and read a paper on California and Colorado Loco Poisons.

California and Colorado "Loco" Poisons.

BY DR. A. KELLOGG.

Dr. Kellogg stated that very many thousands of horses, cattle and sheep had been poisoned by plants, exhibited and accompanied by sketches, called the Rattle Weed, Pompous Pea, Pop Pea, or Menzies' milk, Vetch, (*Astragalus Menziesii*, Gray) of the vicinity of San Francisco, and also quite widespread over the State. The fact had been known to himself and to the public for the last ten or fifteen years. How long it has been known to the native Californian he was unable to say, but reiterated experience has taught sad lessons to independent observers everywhere. To some, however, the cause of their misfortune still remained a mystery. He had reason to know that there are also other similar causes, of which more would be said hereafter.

The subject had been frequently brought before the Academy, but as no records had hitherto been made, he thought it proper to suggest that much useful information was often thus lost—was glad to add that no such fault could be attributed to Mr. Yale, the present indefatigable Secretary.

This, and some allied forms, have been figured and published here; so that the public are supposed to be somewhat familiar with it.

The plant has much the appearance of *Bladder Senna*. As no chemical analysis has been made, nor any carefully-noted experiments tried on animals, all we know is the serious results, often obscurely and imperfectly reported by the farmer, ranchero or herder, and the shepherd.

Horses and cattle in this vicinity, he noticed, would shun it so long as the pasture was good, but as it became bare, and hunger impelled, they would eat it, and became narcotized or intoxicated, stagger, and are unsteady in all their movements, act strangely and stupidly, losing their good "horse sense" or common brute sagacity, in short, acting like a *fool;* hence the Mexican name, "*Loco,*" given it. At length they become thinner, and cannot be restored to "condition." The brutes get to like the weed more and more, being apparently as infatuated as the Sandwich Islander is for his "Ava," (*Macropiper methysticum,*) in water, which demoralizes worse than ardent spirits, or the drunkard for his bottle. If only slightly "*locoed,*" the animal, to a great extent, becomes unfit for uses, except the simplest kind, being unreli-

able in perilous paths or ordinary emergencies, acting so like a fool, to the shame of all sensible animals.

What is most remarkable with this, and the Colorado *Loco*, is the permanence of the impression, often lasting many months, or even for years, half demented, until at length they die. Death often supervenes suddenly; the effect is similar with horned cattle and sheep. The allied *Tephrosia*, or Devil's Shoe-string of the south, although it stupifies and intoxicates, yet the impression soon wears off. This species of Rattle Weed is by no means confined to damp ground, but thrives well on dry hills and all soils. The stem is tall and leafy, growing in bunches from a perennial root, leaflets many-paired (twenty or more), stipuls at base of the leaves trianguloid, membranaceous flowers dirty pale yellowish or whitish, tinged with red, bent forcibly back. Pods inflated, about two inches long, and thinly membranous, indeed so bladder-like that boys amuse themselves by popping them—hence the name "Pop Pea."

Lambert's milk-vetch, of Colorado Territory, *Oxytropis Lamberti*, Pursh; (*Astragalus Lamberti*, Spreng.) consists of about six to eight varieties, which, for all popular purposes one description might suffice. The root is perennial, stemless, or nearly so—not considering the flower or fruit-scape, as such—they grow in tufts or stool-like suckers, springing out by very short branches from the root-crown—are more or less silvery, satiny-silky in every part; the common leaf-stem is about three inches long, the upper oddly pinnate portion the same, or whole length of leaf about six inches, or much shorter than the flower scape stem; pea-blossomed flowers, purplish, blue and white, violet, etc.; leaflets five to fourteen pairs, usually about eight or nine; stipular appendages at the base of the leaves, at, or under the soil, sheathing; pods white, satiny-silky, with very short close-pressed hairs, erect, somewhat cylindric, one-half to an inch long, sharpening out at the point, and partly two-celled.

Found from Saskatchewan to Texas, New Mexico, west to Rocky Mountains, and Colorado to Washington Territory, and, in the opinion of Hooker, to Arctic America and Labrador.

Of this species of "*loco*" we have no personal observation. Asst. Surgeon P. Moffatt, U. S. A., writing from Fort Garland, Colorado Ter., says: "Cattlemen inform him that the weed abounds in damp ground; he is assured that after eating it the animal may linger for months or years, but they invariably die from its effects. The animal does not lose flesh apparently, but totters on its limbs, and becomes crazy. While in this condition a cow will lose her calf and never find it again, and will not recognize it when presented to her. The eyesight becomes affected so that the animal has no knowledge of distances, but will make an effort to stop, or jump over a stream or an obstacle while at a distance off, but will plunge into it, or walk up against it on arriving at it. The plant pointed out to him seemed related to the Lupin"

The members were notified that the appointments of corresponding members would be made shortly, and those desiring to present names could do so by leaving their lists with the Secretary.

VOL. VI.

Regular Meeting, February 1st, 1875.

Second Vice-President in the Chair.

Forty-five members present.

The following new members were elected:

Cornelius Herz, Horatio Stone, J. R. Scowden, Jeremiah Clark.

Donations to the Museum: From I. C. Raymond, a valuable case and drawers. From J. C. Merrill & Co., the spy-glass that originally belonged to Capt Wm. Bligh, who commanded H. B. M. ship *Bounty* when taken by the mutineers, who afterwards settled Pitcairn Island. The glass was left at Tahiti, and came into the hands of Kamehameha III of the Hawaiian Islands, and was presented by Kamehameha V to Capt. Joseph Smith, who left it with Messrs. J. C. Merrill & Co., who present it to the Academy. They also donate a family Esquimaux boat or "oomiak;" also teeth of whale. Dr. H. Behr presented the web of the larvæ of the Eucheira Socialis from New Mexico, found in about the same climate as California. It feeds on a species of arbutus, and could therefore be introduced if desired. It forms a waterproof sac or bag into which it retires for shelter from rain or storms. This bag is remarkable for its exceeding delicacy and lightness. W. G. W. Harford presented several specimens of Crustaceæ from Santa Barbara, *Epicellus productus*, *Hippa analoga*, and two other species. W. J. Fisher presented thirty specimens of Crustaceæ from Japan, Behring's Straits and Arctic Ocean. Several of these species are new, and none of them are in the cabinet of the Academy.

T. J. Lowry, of the U. S. Coast Survey, read the following:

The Protracting Sextant—A New Instrument for Hydrographic Surveying.

BY T. J. LOWRY.

Sextants, and the three-arm protractor, are indispensable instruments, in hydrographic surveying. And in the special work of determining and plotting the position of the sounding-boat or vessel in the usual manner by the *three-point problem*, they are the only instruments of precision in use; and yet the

facts of there being three separate instruments and requiring the simultaneous and rapid manipulations of two observers (and their subsequent efforts in setting off the angles on the protractor) have long been felt to be defects. And the hydrographic world has studied, but unsuccessfully, to devise an instrument that would do the work of these three. But this problem finds a solution in my *protracting sextant*, which enables one observer to accomplish in hydrography the desideratum of measuring at the same instant two angles, and plotting them with the same instrument.

We have represented here in the annexed figure, "The Protracting Sextant," consisting of a circle D, graduated to degrees and minutes from the zero point around by the right and left each way to one hundred and eighty degrees, and three radiating protractor arms, f, g and h. The arm g, is fixed with its true edge at the zero point of graduation, and the other two, f and h, are capable of being revolved around the hollow cylindrical axis of the circle. Between this fixed, and each of these movable protractor arms, we have an index arm—and each of these indices, m and n, also find in the center of the circle a common center of motion, and carries an index-mirror mounted perpendicular to its plane of motion but slightly eccentrically so that the hollow axis of the instrument can be readily gotten at. Along these index arms m and n, are cut rectangular slots (whose longitudinal axes are radii of the circle), in which slide the projecting ends of the pivots which rivet the equal rectangular bars, o, s, and u, w, together. And these indices and protractor arms are so connected by means of jointed parallelograms that the right hand index-arm always bisects the angle included between the fixed and right hand protractor arms, and the left hand index always bisects the angle contained by the fixed and left protractor arms.

Now by a well-known optical principle we know that the angular distance moved over by a mirror while measuring an angle is only one-half of the actual angle measured, and since each of the movable protractor arms of this instrument is by means of this jointed parallelogramic gearing, driven along its arc simultaneously with, and *twice as fast* as its corresponding index-arm (and mirror), we hence see that the angles included between the fixed and movable protractor arms are the actual angles which the indices (and their mirrors) have measured.

The index mirrors, y and z, may be mounted to move either in the same or in parallel planes, as shown in the forms of the writer's two-angle sextants described in the proceedings of the Academy, February 16th, 1874. A horizon glass, x, half-silvered to admit of direct and reflected vision is attached to the frame of the instrument nearly opposite the index mirrors, with its plane perpendicular to the plane of the instrument. The arms, f and h, are clamped and adjusted with the ordinary clamp and tangent screws, l and k.

The requisite adjustments of the "Protracting Sextant" are the same as those of the ordinary sextant. When observing with the new Protracting Sextant, the hydrographer holds it lightly in his right hand and moves it until its face is in the plane passing through his eye, i, and the three objects, A, B, C, whose angular distances are required, and then sets and clamps his index arm so that the reflected and direct images of the objects (say left hand and middle) of one of the angles which he is to measure, are not coincident

yet approaching on account of the progress of the boat; then with the second index glass he makes the direct and reflected images of the middle and right hand objects coincident, and keeps them coincident with tangent screw until the first two objects become coincident, then clamps, and he has the two angles observed at the same instant—and also has them set off on the proper limbs of the instrument simultaneously with, and by the same effort that measured the angles. And hence after measuring two connected angles with this instrument, we have only to lay it down on the "Field Sheet" (which should always be spread on a board before the observer in the boat), and shift it until the fiducial edges of the three protractor arms traverse the three points (representing the signals observed upon), and the center of the instrument will then occupy the relative place of the observer; now dot the center, and the position is plotted, without any of those tedious transfers of angles from the limbs of sextants to the limbs of the protractor, which are unavoidably incident to the execution of practical hydrography with the forms of sextants and protractors now in general use.

However, with the hydrographer, it is necessary to read the angles off of the instrument and record them for future reference and closer plotting on the "Office Sheet."

The angles observed with the Protracting Sextant, or any other reflecting instrument, are measured in the plane of the objects. If this plane be inclined to the horizon and a result rigorously accurate be sought, the angles of elevation of each station above the horizon should at the same time be observed to afford data for reducing the hypotheneusal to the horizontal angle. But this reduction may be neglected in all cases where the difference of elevation of the objects does not exceed two or three degrees, and when the observed angle is larger than (the minimum angles allowed in determining a boat's position by observations from the boat), twenty or twenty-five degrees—for the reduction to the horizon would, in such cases, deal with quantities more minute than the amount of error to which the measures of all angles observed at an unstable station are liable. When the difference of the objects is considerable, an ideal vertical line may be drawn from the highest object downward to an elevation corresponding to that of the lower object, and the angle measured between this vertical line and the lower object —this with some experience and correctness of eye, will give results sufficiently near the truth, *i.e.*, within the limit of the errors of plotting. Objects very close should not be observed on account of the parallax of the instrument.

The Protracting Sextant should have supplementary attachments (such as were described by the writer before the Academy, February 16th, 1874), so that angles between one hundred and forty and one hundred and eighty degrees may be measured with equal facility with those of smaller magnitude. But these larger angles cannot be plotted in the usual way, for they are too great to be set off at the same time on the limbs of the instrument because of the jamming of the movable protractor arms; now, under this contingency, if we have no tracing paper, and don't wish to sweep the circles of position, then we may use the following easy and accurate method of plotting by supplementary angles, viz.: Suppose A, B and C, the left, middle and right hand objects on which are measured two angles, too large to be set off on the

limbs of the protractor at the same time, then set off the supplement of the left hand angle on the right hand limb, and the supplement of the right hand angle on the left hand limb; cause the right and left arms of the instrument to traverse points *A* and *C*, respectively, and draw a line along the middle arm, then shift the center of protractor (taking care to keep the points *A* and *C* bisected by the true edges of right and left arms), and draw another line along middle arm and the intersection *J*, of the two lines thus drawn, will be a point on the right line through point *B*, and the required place of observation; draw this line through *B* and *J*, and with the center of the instrument on this line, cause the fiducial edges of the right and left arms to traverse *A* and *C* respectively; dot the center, and this is the place of observation.

Another method of plotting a position by supplementary angles is to set off the right hand angle on the left hand limb, and the sum of the supplements of the observed angles on the right hand limb of the protractor—cause the left, middle and right arms to traverse the middle, right and left signals, respectively; dot the center, and it is the required position.

And this instrument also enables the hydrographer and topographer to determine and plot their positions by the two point problem (in a manner equal in accuracy and second only in point of simplicity to that by the three point problem), as shown by the writer at page 18, Vol. 2 of "The Analyist." And, in fact, with one piece of tracing paper and the Alidade, the topographer can plot his position, by the three point problem—and with two pieces of tracing paper and the Alidade, he can plot his position by either the two or four point problems shown by the writer at page 146, Vol. 1, of "The Analyist."

This instrument also furnishes the ready means of *orienting the sounding boat.* If out in a bay, lake or river, or along near the sea coast, and your compass functions badly, and you have while angling and plotting, or for some other reason lost your bearings, and hence wish to catch some fixed object ahead or astern on the general direction of the line you wish to run—then take from the sheet, with the Protracting Sextant, the angle between some visible signal and the general direction on which you desire to continue your line of soundings, and then lifting the instrument to your eye, shift it until you bring the image of this signal into the horizon glass, and whatever fixed object this image then covers will be a point on the desired course. By this means, the hydrographer, even if out on a large expanse of water, and swept about by winds and currents, with his compass crazed by local attraction or the heaving of the waves, may "orient himself," and thus ply the helm more intelligently. And, in fact, by this maneuver, and by observing (and plotting as you go) twice or thrice as many angles as must necessarily be recorded, the boat can be steered without the aid of the compass. These practical hints will be found to come most opportunely to the relief of the distressed hydrographer when surveying close in shore along much of the Pacific coast, with its beaches of ferruginous sand, or along the iron bound shores of Lake Champlain, where the magnetic needle often becomes worse than useless.

In nothing will the skill and dexterity of the hydrographer be more advantageously displayed than in deciding *at once* upon the line his boat is to pursue, and with the glance of intuition grasping all the conceivable combinations of visible points that will determine his position. But in practical

hydrography no less necessary than this skill and dexterity, is rapidity of execution in determining positions; and, to this end, with two observers, the requisite promptness and oneness of action are found deplorably deficient, and that, too, at moments the most critical. A sunken rock or reef is to be determined, and on it a sounding gotten. The rock is found, the "cast" is taken—the word "stand by for an angle" is given—and at length comes the response, r-e-a-d-y; by which time perhaps a tangent screw is jammed (hard up) or the boat has drifted from over the rock, and thus the reward, for hours, or it may be for days, of persistent and arduous exertions is lost. And such mishaps must ever continue to recur where two observers are called upon to act quickly and simultaneously under exciting circumstances.

But if in the boat there is *only one observer*, with a Protracting Sextant, then we may confidently expect that promptness and oneness of action, in observing, under every contingency, which are so essential to the rapid and successful execution of a hydrographic survey.

Although we do not presume to say that the theory of this instrument is so obvious, or its manipulations so simple, that "the simpleton, though he run may understand," or that the smatterer and blind routiner (who could not look a quadrilateral in the face without blushing) may manipulate it with ease and accuracy, yet we do not assert without the fear of a contradiction, that to the eye of the ingenious geometer, its theory is most clear, and that in the hands of the hydrographer, who is a master of his profession, this Protracting Sextant will be found the ready and efficient means of determining and plotting (unassisted and alone) his position, with a facility, ease and accuracy not now attained with two ordinary sextants and one protractor in the hands of two observers and one plotter.

The Secretary read the following from Professor George Davidson:

Transit of Venus.

BY GEORGE DAVIDSON.

To the California Academy of Sciences, San Francisco, Cal.:—The instructions of the Commission permit me to give general results of our work, and I condense as much as possible for presentation to the Academy, our labors of preparation and final results.

We have determined the difference of longitude by cable, between Nagasaki and Vladivostok, whence it will be carried westward to St. Petersburg by telegraph, and in connecting the Venus Station with the Telegraph Observatory we have determined the latitude and longitude of the French Venus Station and two other points on the bay.

We have determined the latitude of our station by the Talcatt method; observing upon twenty pairs of stars for five nights.

We have observed fourteen occultations of stars by the moon for longitude differences with Peking and other stations. This was work which we had to

discontinue on account of the smallness of the party and the continued hard labor to be done.

Incidentally we have determined the magnetic declination, magnetic dip, and horizontal intensity.

Of course all our work looked to only one object—the Transit of Venus. And in order to be properly prepared for work thereon, I had erected on a hill, 900 feet high, three miles to the north of our station, an artificial Venus under four different phases. First, when the planet was about four-fifths or more on the disc of the sun; this was for practice in measuring the distance apart of the cusps by means of the double-image micrometer of the equatorial. Then when she was 40 seconds on the disc. This was to study her appearance and to measure with the micrometer the distance of the limb of the planet on the sun's disc. A third phase was when Venus was 40 seconds wholly within the sun's limb. This was for measuring the distance apart of the limbs of the planet and of the sun. Another phase was to study her appearance when only 10 seconds on the sun's disc; and this was one of the most instructive studies, as convincing one that, with instruments the size of our equatorial, that is, 5-inch objective, it is next to impossible to observe the contact with the eye alone, until she has entered fully five seconds. Another practice was to measure the diameter of the artificial planet. As these phases of Venus were drawn to appear of the same size as I should see her, the practice of measuring upon them, under all circumstances, of clear and cloudy weather, steady and unsteady atmosphere, gave me confidence in what I should be sure to see in a week or more.

Before the day of the transit we were ready and anxious for the event; the weather was gathering for the worse and the prospect was decidedly bad. On the morning of the 9th, at 4 A. M., when we observed star transits, the sky was as clear as a bell; at 5 A. M. densely clouded. The clouds broke partially at about half past 8 A. M., and we obtained our preparatory photographs and had all the final adjustments made by 9:15, when the clouds thickened, and the prospects were dark as the lower stratum of clouds touched the mountain top four miles south of us and only 2,000 feet high. There were two strata of clouds—the upper one, moving very slowly, was a curtain of cirrus and cirro-stratus; the lower gathering heavily and slowly from the southwest, was cumulo-stratus. Ten minutes before the first contact a break in the lower stratum occurred, and near the first. I was sure of it, but a thicker mass deadened the image so that I could not be sure of the contact; and when the light increased, the planet was certainly ten seconds on the sun's limb. Then the clouds increased, and no measures for cusps could be undertaken until the planet was half way on, when it became bright, and I observed the second contact as well as such an event can be noted by eye alone. There was no ligament joining the limbs of Venus and the sun; no black band or black drop. There was a slight unsteadiness of limbs, such as we see in our regular groedetic work, but no hanging together, no distortion of outline of either. The separation might have been much sharper, but the result could not raise a doubt of more than two seconds in my mind.

Then I commenced measuring with the double-image micrometer the separation of the limbs until Venus was on one diameter; then made measures

of the diameter of the planet. These were made to study the question of irradiation. During this time there was no sign of an atmosphere or haze around the planet. In these different measurements about 150 micrometer readings were taken. I should here mention that Mr. Tittmann, the first assistant astronomer, also observed the second contact with the Hassler 3-inch equatorial of the Coast Survey, and noted no ligament or band.

After diameter measures came thicker clouds, but fortunately at noon they broke away, and with the Coast Survey meridian instrument No. 2, I was enabled to observe the meridian transit of the sun's first limb over nine threads, the first limb of Venus over eight threads, the second limb of Venus over eight threads, and the second limb of the sun over six threads. Mr. Tittmann with another transit measured the difference of declination of the upper limb of the sun and both limbs of Venus by eighteen micrometer readings. These meridian observations and the diameter measures were not contemplated by the Commission.

Then the weather thickened and threatened rain; but at third contact broke away slightly, and I was defeated in the third contact. Just a few seconds before, I had the line of separation very narrow and well defined, and without ligament, but the clouds deadened it, and even without colored glass it only cleared to let me see that the planet had broken across the sun's limb about five seconds; thence to close, dense clouds.

During the day there was no time after 10 A. M. when the sun shone from a blue sky. The upper stratum of clouds acted as a screen to the sun's heat-rays, and the atmosphere was quite steady. Objects at a distance were dark but clearly defined.

Of photographs we got none near first contact: only began to receive them when the planet was half on. After that we obtained about sixty good ones.

Altogether, with the second contact, the micrometric measures, the meridian transits, and the difference of declination, and the photographs, I believe we have more than average satisfactory results. We did our best; there was no hurry, no jar or clash or hindrance; everything worked smoothly and like machinery. as by our practice and drill we had anticipated.

Our observed first and second contacts were about 1 min. 45 seconds after American Almanac data, and about 3 minutes 30 seconds after the English. The third contact was near the time of the American data.

Enough. In a subsequent letter I will place before the Academy my opinion of methods and instruments and elevations to be chosen for the transit of 1882.

Dr. Gibbons read a paper on "Climatic Changes in California."

W. N. Lockington read a paper on "Sponges."

The following papers by Dr. J. G. Cooper were submitted:

The Origin of Californian Land-Shells.

BY J. G. COOPER, M. D.

In previous articles I have given some observations on the Distribution and Variations of the Californian Banded Land-shells, which naturally lead to the consideration of their probable origin or past history.

In the "Bulletin of the Museum of Comparative Zoölogy," (Cambridge, Mass., June, 1873, p. 202), Mr. W. G. Binney writes, "the west alone is left to us from whence to trace the Pulmonate Fauna of the Pacific region, and there the secret of its origin lies buried under the Pacific Ocean."

Mr. Binney probably alluded to the supposed existence of a continent in the South Pacific, embracing the mountain summits now forming the archipelago of Oceania, which became submerged, as Prof. Dana suggests, during the later tertiary period, while most of California was emerging from the ocean.

But even if this were proved to have happened, the great distance of the nearest islands (the Hawaiian) from us, and the great depth of the ocean between, as well as north of them, besides the total dissimilarity of their living land-shells from ours, forbids any supposition of a former land connection by which such animals could travel directly from one country to the other. A glance at a globe shows that the islands, besides being tropical and wholly south of lat. 23°, are as far from us as the Aleutian Islands, the Arctic Ocean, or Florida, and I propose to show that whatever migration to California has occurred, came from the direction of the regions named last.

No confirmation is given to a derivation from the west, by the more probable former existence of an "Atlantis" connecting the two continents across the Atlantic, the few island remnants of which really contain several species of land-shells common to one or both sides.

The great similarity of our banded groups to those of Europe has always been an argument for supposing them to have had a common origin. The same similarity is found in many others of our animals as well as plants, and is plainly connected with the well-known similarity of climates in the two countries. But as the known laws of nature do not permit us to consider climate as the cause of specific resemblances, we must look for some other way of accounting for them in this case.

The fact that very similar species exist in Japan and the Amoor Valley, Siberia, contradicts, indeed, the theory of climatic causes, since we know that the climate of those regions is very similar to that of our Atlantic States, where no similar species exist. At the same time, their existence there suggests the probable central point from which all originated.

Going back in geological history to the supposed beginning of all living species, few, if any, of the terrestrial, can be traced farther back than the

Eocene Tertiary, and most of them much less far. But some included in the comprehensive genus "Helix," are found fossil in the Eocene of Nebraska, etc., sufficiently like living American forms to be considered the "Darwinian" ancestors of perhaps the whole of them! Or we may go back only to the Miocene epoch, when trees scarcely distinguishable from the Californian Redwood and *Libocedrus* flourished in Greenland and Spitzbergen, between lat. 70° and 78°. What is more natural than to suppose that land-shells also, like those now living among our redwoods and cedars, existed in the shade of those trees? I have no doubt that such will yet be found fossil in the lignite beds of the Arctic Zone.

It is easy then to see, that having their central position (if not their origin) in points so near the present North Pole, the subsequent gradual cooling of those regions, which is supposed to have driven the living species of Redwoods southward to California and Japan, as well as other trees into Europe, would, if a slow change of climate, also drive southward the land-mollusca "at a snail's pace" into the same regions, where we now find their descendants occupying countries, which are about equidistant in longitude, around the northern hemisphere, in lats. 40°-50°.

We have strong confirmation of this theory, in the well-known distribution of circumpolar species of land-shells southward, on both continents, along meridians of similar temperature, and along mountain ranges (especially those running southward, as in America), and which are supposed to have thus migrated south during the "Glacial Epoch."

Besides these two groups, the "circumpolar" and the "representative" species, we also have on the west slope a very few of the Eastern American types. I do not, however, consider these as evidence of a migration *westward*, but would explain their occurrence as proving a former existence of ancestors common to both, in the middle regions of Oregon and Nebraska, where are found so many tertiary remains of animals that once inhabited both regions, before the Rocky Mountains became a barrier to migration, or caused different climates on the two slopes.

The few fossil land-shells yet found in California are not sufficiently abundant or ancient to furnish data for their geological history. The fresh water forms, however, which I hope at some future time to describe and illustrate, indicate a very different and more tropical group in the Pliocene and Miocene strata.

The occurrence of *Pupa* and *Conulus* in the carboniferous strata of Nova Scotia, shows that land-shells existed long before the Eocene period.

The great northern glacial drift, and local glaciers farther south, have so generally destroyed the softer tertiary deposits that it must be long before the routes of migration can be traced from Greenland southward, but as tertiary land plants are found there fossil, some similar deposits must have escaped elsewhere in the intermediate regions. Species much like the living ones of California may be expected to occur in the Pliocene of British Columbia.

There can be no doubt that the local migration has been *westward* along this coast, from the facts before stated as to the occurrence of species in the coast ranges and islands, which are unquestionably not older than Pliocene in age, while their allies in the Sierra Nevada may have existed there since the Eocene, but at a greater elevation than they are now found. As they move

westward, we also find the few older forms developing into many "specialized" varieties.

Going south of California we find further confirmation of the theory of southward migration in Mexico, where species closely resembling the *Pomatia* of Europe occur on the higher mountains, which, unless special creations, could only have reached the two regions by a process like that I have described. The genera *Bulimus*, *Glandina* and *Clausilia* may also have traversed a similar route, though their absence in the tertiary strata of the Eastern States seems to be evidence to the contrary. They may, however, be found in the tertiary of the Great Basin, which is known to contain fossils of some other genera now found only south of the United States (*Berendtia* and *Holospira*). Indications, however, are known, which point to a connection of tropical regions by land in tertiary times, independent of a polar route. The supposed "Atlantis" connecting South America with Africa would also have connected it *eastwardly* with Asia and Oceania.

The humble and despised snails thus become among the most important evidences of geological changes and conditions of the land, climate, etc., in the past history of the globe. Being terrestrial and easily fossilized when of moderate thickness, they furnish evidence not supplied by any other class of fossils, while their persistency of types is shown by the close resemblance of the carboniferous species to modern tropical forms. One species at least, which still lives in the Eastern States, is found only fossil in England (in Pliocene or later strata) like the trees found under similar conditions, and careful examination of fossil forms on both continents will no doubt show other curious coincidences.

It may be mentioned also that genera of abundant occurrence in the Eastern States have a few representatives in Europe and Asia, as they have on this Coast.

Every fact like this tends to prove that their former migrations have not been to the east or west, but from a common northern centre toward the south.

On Shells of the West Slope of North America.

No. III.*

BY J. G. COOPER, M. D.

Genus Helix Linn. A very thorough investigation of the subject with the aid of all the light afforded by the works of Pfeiffer, etc., has brought me to the conclusion that the *Linnean* type of Helix must be a form very different from *Pomatia*, and probably including the Californian banded forms. After excluding *Planorbis*, a prior genus, *Pythia*, and perhaps others, not agreeing with the diagnosis, the first Linnean helicoid land-shell is *H. lapicida*. Although this does not agree well with the diagnosis in form, it has been shown by Mörch to be of the same genus, as to the soft parts, lingual teeth, etc., as *H. arbustorum*, and probably *H. Hispana*, which are typical in form, and were

*See Vol. III, pp. 62, 259, 294, 331, IV, 92, 150, 171, V, 121, 172, and Amer. Jour. Conch.

placed by Linnæus in about the middle of the series, *H. lapicida* representing indeed their carinated condition. Furthermore, Pfeiffer only quotes Edition XII, for "*H. Pomatia*," while the genus *Helix* was founded in the Systema Naturæ, Ed. X.

Other species have been subsequently adopted by authors as the type, but the laws of nomenclature seem to require that the first-named, or most typical and well-known species of the author, should be considered his generic type. *H. lapicida* occurs in Sweden, but none of those adopted by southern authors do so. Each of the latter seems to have taken a form used as food or medicinally, but less known to Linnæus. Until Hanley identified the Linnean types of species, two of them were even supposed to have been unknown to him! We may therefore give:

1. *H. lapicida* (or *H. arbustorum*) as type of Linn.
2. *H. grisea* L. (="*aspersa* Müll." *Hanley*) as type of Risso.
3. *H. Pomatia* L. (Syst. Nat. Ed. XII) as type of Fitzinger.
4. *H. lucorum* L. (="*lactea* Müll." *Hanley*) as type of Swainson.

Thus it becomes necessary to consider *H. lapicida* the Linnean type, and *Arionta arbustorum* as subgeneric, though Mörch has placed them in the contrary positions. As to *H. Hispana* there seems to be some doubt, as it was not recognized by Hanley among the types, and the description is not full enough. If, however, it is the *H. umbilicaris* Brum., it is the type of *Campylæa* Beck, which probably includes part of the Californian species, formerly placed by me in *Lysinoe* (*Aglaia* part, auct.). It comes nearly between "H. fidelis" and "H. Dupetithouarsi." *C. setipila* Ziegl. is placed next to *H. Mormonum* by Pfeiffer, and retains its bristles permanently, like var. *Hillebrandi*. Besides the 1-banded or fillet-banded series like ours, there is another in Europe with 3 or 4 bands, which seems a passage to the § *Pentatæniæ* to which *Pomatia*, etc., belong. Compare also "*H. peliomphalia*" Pf. and *H. Simodæ* Jay, of Japan, *H. Middendorfii* Gerst. Amoor R., *H. jaspidea* Pf. and *H. Patasensis* Pf., Andes, Peru. Species are included in *Campylæa* that are subangled, (e. g. *C. Banatica* Partsch, and *cingulella* Ziegl.) thus approaching *lapicida*, which is said by Mörch sometimes to "have four bands like its allies," but he may confound two species in this case. One, *C. Raspailli* Payr. is imperforate.*

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*I am indebted to Dr. Newcomb for the use of numerous Conchological books.

The shell figured by Chenu (Manuel, I, p. 461) as "*Macrocyclis* (*Vallonia*) *pulchella* Müll.," is a species of *Campylæa* much like *Hispana* (*umbilicaris*) or *cornea*. The error probably arose from the confusion by some authors of *Corneola* (type *pulchella*) with *Campylæa* (*cornea*).

"*Helix peregrina* (Bosc)" quoted by Bland & Binney (Pulmonata Geophila, 186), from "the islands on the west coast of America," is probably Gmelin's species of same name, which Pfeiffer has shown to be probably the same as the "*H. octona*" Chemn. (not of Lam.), *Stenogyra octona* of B. & B. p. 232, quoted by Pfeiffer as from West Indies, Guatemala, West Columbia, Pacific Is. (Opara, etc.) Chemnitz no doubt mistook it for the Linnean *H. octona*, and Gmelin rectified this by calling it *peregrina*, which name probably belongs to the West Indian shell, not in Mex. or Cal. In Pfeiffer's synonymy is also *Achat. Panamensis* Muhlf. Mss., not *Bulimus Panamensis* Brod., but Dr. Newcomb tells me the Panama animal differs from the West Indian, and also considers those of the Pacific Islands distinct.

The name *Lysinoe* proves also inapplicable to our species, being only a substitute for *Aglaia*, of which the type, *H. Audouinii*, is quite different. The Mexican species, *Ghiesbreghti*, adopted as typical, has been made a type of the new subgenus *Odontura*, Crosse & Fischer.

On the whole, the most scientific plan seems to be to consider the West Coast banded forms as belonging to subgenera of *Helix*, and to include them under that name. There are about ten species on this slope, however, which seem to differ enough in the shells alone to be separated generically, besides *Patula*, *Macrocyclis*, *Hyalina*, etc., which differ both in shell and soft parts.

Subgenus ARIONTA.

H. ramentosa Gld. = *reticulata* Pf. Dr. Newcomb informs me that the types sent by him to *both* these authors were from Mission Peak, 25 m. S. E. of Oakland, Cal. The former name has several months' precedence in description, the latter being merely a variety of it, and both are probably varieties of *Californiensis*, with which they are connected by the subglobular form figured as *H. Bridgesii* by Binney & Bland (Pulm. Geoph. 169, f. 294). A very small Oakland specimen is 0.85 by 0.60 inch. Another exactly resembles the Monterey var. in form (*vincta*).

Among the collections of the Geol. Survey of Cal. in 1860, were some Helices, encrusted with lime from a tufa-spring, nearly ¼ inch thick, and supposed to be fossils. I softened the crust in dilute acid, and scaled it off from a perfect specimen of this species, retaining epidermis, band, etc., others being more or less bleached. The locality was "Sergeant's Ranch," about 25 m. N. E. of Monterey (where it is replaced by the vars. *vincta* and *nemorivaga*).

The form of *H. arbustorum* from Switzerland, called *H. Repellini* Charp., seems to represent this var. in Europe.

Compare "*H. lutacea*" Pf. Nov. Conch. I. 120, pl. 34 f. 1 (bandless var.?).

H. arrosa var. *Holderiana*. Specimens found on the east side of San Francisco Bay, along the first range of hills opposite the Golden Gate, for 15 miles N. and S., have the color and seven whorls of typical *arrosa*, but in form and sculpture approach *ramentosa*, being examples of the law of inferior development in a warmer climate, retaining characters of the young of the type. They measure 1.05 to 1.28 by 0.60 to 0.75 inch. The first specimen, found several years since by Mr. W. W. Holder, was considered a variety of *exarata*, being imperfect and faded. Dr. Newcomb identifies it as his "var. of *ramentosa* with seven whorls," mentioned in Amer. Jour. Conch., but I cannot yet see cause for uniting *arrosa* with that series. I am, however, less certain about *exarata* and *arrosa* being distinct, having found specimens exactly intermediate in the Coast Range 25 m. S. of San Francisco. They do not, however, appear to mix at Santa Cruz, where both occur, with varieties of *Californiensis*. The animal of *exarata* differs also in being reddish, not smoky-gray, more slender, with longer tentacles, foot narrower, more pointed behind.

H. arrosa var. *Stiversiana*. A specimen obtained from Dr. Stivers, collected in Marin or Sonoma Co., has but 6½ whorls, and dimensions agreeing with Lea's *figure* of "*Nickliniana*," viz.: 1.05 by 0.70. It has, however, numerous

impressed grooves on the body whorl, parallel to the suture, as in *Townsendiana*, *fidelis*, etc. Others from Point Reyes, Marin Co., are similar, with only 6 whorls. This is possibly Lea's original "*Nickliniana*," which was "longitudinally strite," but the striæ are not mentioned by later describers, and the "5 whorls, whitish, mottled, paler beneath, size 90 by 70, locality San Diego," of Lea, cannot be made to apply to it.

Mr. Carlton received specimens from Sonoma Co. (Healdsburg?) with the same revolving grooves, but more like var. *Holderiana*.

The animal of *arrosa* is smoky-gray, about twice as long as the width of shell, coarsely granulated, the tips of granulations paler; eye-pedicles ⅙ of total length. Foot very broadly expanded, nearly three times the width of body, its margins flattened above.

One from east of San Leandro is a typical small *arrosa*.

H. tudiculata Binn. This species approaches the coast farther north than before reported, being found in considerable numbers in the bottom land of Santa Clara River, six miles east of San Buenaventura, where it lives in colonies near a colony of *H. Traskii*, but without any intermingling of the two species. I found one which had been injured when half-grown, and afterwards formed another whorl without a band, showing that this variety is the result of disease.

They grow only half their greatest size there, it being rather too dry a climate, but the first locality south of Monterey in which a valley runs direct to the ocean from the Sierra Nevada, where they are more perfect. Two species of *Succinea* seem to have followed the same outlet to near the coast. (See notes hereafter.)

These shells come very near "*Nickliniana*" Lea. A tracing of his figure laid over Binney & Bland's fig. 287 (var. "*cypreophila*"), agrees almost exactly, but Lea's description appears mixed with a var. of *Californiensis* (and of *Kellettii* ?).

H. Kellettii Fbs. and vars. In the descriptions of vars. *Tryoni* and *crebristriata* (Proc. Cal. Acad. III, 116), forms are mentioned as sometimes larger, angled, or with lips enormously thickened and connected by a thick callous deposit on the parietal wall. I found these on the islands to which the two varieties mentioned are now confined, the fossils of the two being undistinguishable, except that those of var. *crebristriata* have the tubercle of var. *Tryoni* even more developed than in the living form of the latter (which does not now exist on the same island), while those of var. *Tryoni* have the deep striæ of *crebristriata* well developed.

These were among the proofs on which I considered "*H. Tryoni*" a var. of *Kellettii* in a former article.

In the Journ. de Conchyl. for 1861, Pl. VIII, f. 12–16, are represented fossils from Algeria bearing similar relations to species now living there. Crosse also notices their similarity to the living *H. dentiens* of the West Indies (belonging to the subgenus *Dentellaria*, apparently not very different in animal from *Helix* § *Arionta*). This, together with other Algerian species, both recent

and fossil, closely resembling West Indian forms, as well as some of the Canary and Azores Islands, he considers good evidence of the existence of the connecting land "Atlantis" within tertiary periods at least. The circum-tropical existence of this northern group is, however, to be explained in another way by a southward migration, as I have more fully shown in another paper. The repetition of forms with very thick lips, in different longitudes, on islands between latitudes 35° and 30°, is rather the consequence of the excessive development of shell in mild foggy climates, on islands, especially, where lime abounds. The animals may differ very much, as shown by those with similar shells, from New Caledonia described by Crosse & Fischer. The Algerian fossils no doubt lived when the Sahara was an inland sea, and Algeria a group of islands, the later rise being possibly at the time "Atlantis" sunk.

Our fossil island varieties also show the effects of a former moister and warmer climate, perhaps pliocene.

As might be expected, the Algerian shells belong to a different subgenus, forming a gradual series from the toothless *Tachea lactea*, Müll. ("=*lucorum L.*," Hanl.) to one and four-toothed *Dentellarian* forms, and some of the fossils retain the characteristic five bands of the § *Pentatæniæ*.

Our island Helices also connect with the Lower Californian many-banded *areolata*, etc., which much resemble *lactea*, etc., but according to Mörch, Tachea is a subgenus of the carinated genus *Iberus* (type *Gualteriana L.*)

As partial evidence of the greater antiquity of our fossil forms, we may note that numerous eastern species found fossil in the Mississippi valley Quaternary strata, do not differ from those now inhabiting the surrounding regions. In that case, therefore, there may have been no great change of climate.

The angled form of *Kellettii*, found fossil, is the link connecting our "Arionta-form" species with the "Chilotrema-form" *lapicida*, and with the angled forms of the next group.

Subgenus CAMPYLÆA. (?)

H. Mormonum Pf. In their splendid work on the Land Mollusca of Mexico, and also in the Journ. de Conchyl. XXI, 1873, 263, Messrs. Crosse & Fischer give as a locality, "Sonora, Mex., Dr. Frick." This is undoubtedly a mistake arising from specimens collected by him at Sonora, Tuolumne County, Cal., where he informed me himself that he found it common, as well as at Columbia, near the same place, localities noted for the marble and lime mentioned by me in other articles. Lest other foreign authors may suppose this shell to be from Utah, I may state that the original locality, "Mormon Island," is a rocky islet in the American River, Cal., 70 m. N. N. W. of the town of Sonora, and on the same Limestone belt.*

The animal of *H. Mormonum*, (Pioneer Cave, El Dorado Co., J. G. C.), is long and slender, semi-cylindrical, foot not projecting much behind, flattened,

*In the same works the authors repeat the error of locality for *H. Pandoræ*, viz: "Santa Barbara, Cal.," though it has been several times exposed. They also redescribe *Nassa fossata*, Gld., as "*N. Morleti*, Crosse, Habitat unknown." J. de C., 1868, 169, Pl. VI, f. 3.

wedge-shaped. Color dark brown, tentacles darker. Surface thickly studded with paler tubercles very regularly arranged in front, less so behind the shell. A deep furrow at upper edge of foot, which spreads to twice the width of the body, forming a sharp edge all around. Head obtusely rounded, tentacles long and slender.

It resembles that of *H. Traskii* most nearly, differing much from the others nearest allied in their shells.

A remarkably flat variety of *H. fidelis*, found by Mr. Harford at Dalles, Oregon, is so much like forms of this species as to suggest that they are of a common origin. If the animal proves to be intermediate in colors, it will show that they are only varieties of one species, but so far as known, the animals are more distinct than usual in shells no nearly allied.

H. Traskii Newc. Specimens from near San Buenaventura, where it abounds in moist bottom lands, have the young shell bristly up to the growth of four whorls, but the adult shows no trace of this. The animal has the form of that of var. *Diabloensis* (figured in Proc. Phil. Acad. 1872), but differs in paler purplish (not slaty) tint, and tubercles tipped with white, probably only a more southern variation. The young shell is also distinctly subangled, though not always to the same degree, some being far flatter above than others. Out of over fifty adult shells, one measures 1.30 by 0.60 inch, looking like a pale *H. fidelis*, with but 6½ whorls. I found them to be in the habit of climbing small willow trees in a swamp up to a height of 12 feet.

Dr. Yates has found var. *Diabloensis* in Colusa Co., 100 miles north of Mt. Diablo, near Cache Creek, the outlet of Clear Lake, inhabiting only the eastern ridges of the coast ranges as farther south. Also near Calistoga, Napa County. The supposed hybrid mentioned by me in these Proceedings, III, 331, is the type of this form.

H. fidelis var. *infumata* Gld. In a former article, I have stated that specimens from Humboldt Bay are intermediate between the northern and southern shells; also suggesting that the latter might sometimes show the normal bands of the group. I have verified this suggestion by finding a young faded specimen two miles east of Oakland, in which the darker band is quite distinct just above the angle, on several upper whorls, the light marginal "fillets" also showing above and below it. This specimen is also roughly ribbed and clouded above, exactly as in *H. lapicida* for which it might be taken if found in Europe.

It will be observed from the description of the colors of the animal here given, that they resemble those of *fidelis*. All the species analogous to "*Campylæa*" differ much more in animals, as well as in shells, than the "*Arionta*" group. This is connected with their extensive range in latitude, while the latter are limited to more constricted circles, as shown in the article on the "Law of Variation."

The animal is black, with brick-red tubercles, conspicuous even to the end of the tentacles, the furrows of the back not quite symmetrical, except one on each side of the median dorsal line. Mantle edge smoky gray. Length twice the diameter of shell; height of body half the breadth of foot. Form and tentacles more slender than in the polished species; tail sharper. The

slender elongated form is always connected with many whorled species, having a rather narrow aperture in the shell.

Specimens from Alameda Cañon, about lat. 37° 30′, its most southern known range, have the scaly epidermis as much developed below as above. As in bristly species this roughening seems to aid in concealing the shell by retaining a coating of mud.

Mr. G. W. Dunn has found many of this species on the branches of Buckeye trees (*Æsculus*) near Baulines Bay, showing another resemblance to its ally *H. fidelis*.

Dr. Yates has found it near Calistoga, Napa Co.

I have also found banded young of all ages under the loose bark, up to 20 feet above the root of a dead tree, at Haywards.

Glyptostoma Newberryana W. G. Binn. In the Amer. Jour. of Conch. V, 190, Bland & Binney call this a "true Helix," but from their description of jaw and teeth merely prove that it is neither a *Macrocyclis* nor a *Zonites*. Since then they have made it the type of a subgenus *Glyptostoma*, from the grooves in aperture. According to the Agassizian rule, the external form of the shell is enough to separate it from the same *sub-family* with any type of *Helix*. The animal differs materially also as follows:

Length 1½ times the width of shell, spiracle just above middle of its back when creeping, only ¼ inch from angle of aperture. Granulations very long and coarse, reticulately furrowed between, and one straight furrow running obliquely down from spiracle toward mouth on right side of body, about five furrows above, and five below it. A distinct furrow around flattened margin of foot, with branches connecting it with another close to edge. Tail flattened and obtusely wedge-shaped without mucous gland. Eye-pedicles nearly one-third of length of body, and like lower tentacles, finely granulated. Foot *narrower* than height of body. Color smoky gray, foot paler beneath, edge of mantle yellowish.

The form of the animal is indeed almost the same as in our species of *Macrocyclis* (and this of course is connected with the similar form of the shell), but the external characters otherwise differ as well as the jaw and teeth.

Genus Mesodon Raf. Rafinesque's "General Account, etc.," 1818, mentions as found in Kentucky, of "Helix four species," while his descriptions of *Mesomphix*, etc., distinctly state that he considered the typical *Helix* imperforate, no doubt adopting the type of his friend Risso (and of Leach?), viz.: *aspersa* (="grisea L." teste *Hanl.*) Taking W. G. Binney's list of species of the "Interior region," it is easy to identify the four nearest to that type, viz.: *albolabris, multilineata, Pennsylvanica, Mitchelliana*. His "twelve species of *Mesomphix*" include some of *Macrocyclis*, *Zonites* (and *Patula?*); his "*Trophodon*, ten species," must include the "*Odotropis*" of next year. Both are from the same Greek words, meaning "toothed whorl." From his later "Enumeration, etc.," 1831, it appears that he divided *Trophodon* into three groups, giving the name "*Mesodon*, 1819," to the first, though it is known only as a catalogue name, the *M. leucodon* of that date. The description "Differs from *Helix* by lower lip

with a tooth. *M. maculatum*. Depressed, five spires, hardly striated, upper lip reflexed, tooth careniform. Fulvous with brown spots," agrees best with *multilineata*, for he does not state that it has a tooth "on the spire," as in *Odotropis*, but a "careniform" ridge on the *lower* (not "inner") lip. Thus Mr. Tryon's statement that he figured *albolabris* as type in Mss. is intelligible, showing that the tooth referred to was not on the parietal wall as usually understood.* We must then suppose that he made the genus to include the species he before placed in *Helix*.

It appears most proper, if we adopt any of Rafinesque's names, to use those published before 1825 in preference to later ones, invented after his mind became affected. His earlier writings are as clear as those of most naturalists of his time, and from his allusion in some places to unjust suppression of his descriptions in Europe, we may suppose he would have done better after 1825 but for his unhappy condition. On this account the name *Odotropis* having an excellent description given with it would be far preferable, if he had not unfortunately omitted to mention a type species. As it is, it can only be used for a section, as done by me in 1868.

As to the distinctness of this genus from Helix as defined before, there can be no doubt, and it is still more different from the *Pomatia* group. The large, typical species all differ definably in shell, jaw and lingual teeth, as well as in the form of the animal, which has the foot less expanded. The nearest approach to Helix, in shell, is seen in *O. multilineata* and *O. profunda*, but their bands and jaws are quite different. As subgenera it includes *Aplodon* Raf., *Polygyra* Say?,† *Stenostoma* Raf., *Triodopsis* Raf., *Dædalocheila* Beck.

Mesodon Raf. only differs from *Odotropis* in absence of a parietal tooth and of umbilicus, and *Ulostoma* is synonymous with *Mesodon*, having a tubercle on the lower lip. *Trophodon* Raf. is doubtfully distinct, connecting *Odotropis* and *Triodopsis*, while *Xolotrema* includes only the imperforate species of the last, connecting it with *Stenostoma*.

The lip and teeth alone furnish only subgeneric characters, and the umbilicus is scarcely of specific value. While some of the above divisions approach nearer to *Helix* in internal characters, their shells are still more different.

M. Townsendiana var. *ptychophora* A. D. Brown, Journ. de Conchyl. 1870, p. 392. =*H. pedestris* Gld. (part, animal excl. smooth var.) 1846.

= *H. Townsendiana* var. Bland & Cooper, Ann. N. Y. Lyc. VII, 362, and var. *minor* Tryon, Mon. Terr. Moll. of U. S.

Hab. Montana and Nebraska, Rocky Mts.

It seems yet unsettled whether this species belongs to *Arionta* or *Mesodon*, and I have been unable to obtain living specimens for comparison. Mr.

**Mesodon* Raf. (1819?) 1831, type *H. thyroidus* Say, *teste* Ferussac (from specimens?), *albolabri steste* Tryon from Raf. Mss. "Type *elevata* Say," *teste* Gray, but this was probably a type of *Trophodon* 1818, which differed in the "upper lip notched." Gray, however, followed the strict rule of adopting the first recognizable species named in Ferussac's catalogue = *Odomphium* Raf. 1831 (umbilicate group of *Mesodon*).

Raf.'s Mss. figure of "*M. leucodon thyroide*" is certainly *thyroidus*, but called "spotted," and the trinomial term used indicates that it was not his original type.

†This name though anterior, is inapplicable to all the species.

Binney's latest work states that its lingual dentition differs from the other known *Ariontæ*, approaching the last-named genus.

M. anachoreta W. G. Binn. Compare "*H. læsa* Rve." Conch. Icon. *Helix*, Pl. CCX, describ-d as "granulated, *Hab.* unknown."

Subgenus APLODON Raf. "Differs from the genus *Helix* by its rounded mouth, one-toothed columella, and umbilicus. One specimen in Kentucky, remarkable, *A. nodosum*. Three whorls of spire embossed, and lightly wrinkled concentrically beneath" (Journ. de Physique, 1819). The rounded mouth also distinguishes it from *Stenostoma** and there seems to be no species in Kentucky to which it can apply, except a variety of *monodon*, common in the west, retaining the embossing left by the bristles of the young (*Helix Leaii* Ward). That species forms a link between the subgenus *Stenostoma* and the more different group of *Odotropis*, to which I applied it in 1868.

Our two species are so closely connected as to be hard to separate, and one, the *germana*, has often, if not always, the internal tubercle characterizing most of the subgenus *Stenostoma*. They agree with *O. monodon* in fewer ribs on the jaw than in the type forms.

Mesodon (Aplodon) Columbiana Lea. The uncertainty of the difference in the jaws of this species compared to that of *germana* (as described and figured by Bland & Binney in Ann. N. Y. Lyc. N. H. X, p. 304, pl. xiv, f. 2 and 4) is shown by jaws extracted by myself from shells that would probably be all considered *Columbiana* by those authors.

1. A Sitka jaw is strongly arched, with eight broad ribs.
2. S. F. specimens have nine or ten ribs, stronger, but narrower.
3. A Santa Cruz specimen (toothed and imperforate) has them similar, thus exactly filling the gap between B. & B.'s jaw of *Columbiana* with eight narrow ribs, and that of *germana* with eleven broader ones. The proportions they give for the soft internal organs are very unreliable, as alcohol produces very different forms in those of the same species, and they even differ in individuals with season and age (see *Prophysaon*). I am, therefore, compelled to consider *germana* as only a variety of *Columbiana*. This species has been found near Calistoga, Napa Co., by Dr. Yates, with *Vancouverensis*, *infumata* and *Diabloensis*, associated at no other locality.

M. (Dædalochila) Harfordiana Cp.†

I have heard of what was probably this species in the mountains east of

*This name, used in 1818 and 1831, was evidently intended to include *Stenotrema* described in 1819, that name having been pre-occupied in 1815, and being as applicable to "narrow umbilicus" as "narrow mouth." Raf.'s type *convexum* is prior to Ferussac's name, and his manuscript was probably altered in Europe before printing.

† Genus GONOSTOMA Held. This European form, type *obvoluta*, is connected with my *Ammonitella Yatesii*, by the "*Drepanostoma nautiliformis*" Porro, of Italy, but the three species are different enough, apparently, to form three subgenera. "*H. ammonitoides* Rve." of Australia, is still more like mine in the form of the mouth, but highly colored. The animals of all need thorough comparison, and also with similar concave shells from the Pacific islands. Those who unite mine to Helix should call it "*H. ammonitella* Cp.," there being a *H. Yatesii* Pfeiff. 1855.

San Diego. Mr. Hemphill also informs me that he collected it in Idaho, thus approaching the range of allied *polygyrella*.

Genus PATULA Held. Type "*H. radiata* Penn." (or "*H. alternata* Say.," teste Gray, Genera.)

This genus was founded on one of the group of "*Anguispira*" Morse, a name used by me in the "West Coast Helicoid Land-Shells," but according to Bland & Binney includes also *P. Hornii*" Gabb, and *striatella* Anth., with var. *Cronkhitei* Newc., though not the others I included in it.

P. solitaria Say. Compare "*Helix Kochi*" Pf. Monog. I, figured by Reeve, Icon. Pfeiffer places them close together, but the habitat was unknown. If the collector was the Dr. Koch of "Sea Serpent" fame, he no doubt collected it in Osage Valley, Western Missouri, where he exhumed Mastodon bones. The figure looks like one of the varieties of *solitaria*.

Patula pauper Moric. (not Gould) Alaska. "*Helix ruderata*" Stearns, Proc. Cal. Acad. III, 384 (not of Studer). "*Patula ruderata?*" Cooper, Amer. Journ. Conch. V, 202.

Genus MACROCYCLIS. The animal of the tropical type of this genus seems to need comparison with the northern forms. By strict rules, the name Mesomphix belongs to this group, the type being plainly *concava*, as shown by Ferussac.

M? "Helix" Belcheri Pfeiff. 1, Reeve, Icon. Compare this with the Alaskan form called "*Vancouverensis*," but which seems different. The locality of Belcher's specimen was unknown, but he visited that coast.

M. Voyana Newc. Found rarely in Alameda County, by Dr. Yates and H. Hemphill, common and large near S. Diego. The animals show the following differences:

1. Alameda Co. Dusky white, back purplish-brown, a distinct dark stripe on each side, running back from base of eye-peduncles, which are whitish-brown.

2. San Diego. Yellowish-white, middle of back, stripes and tentacles all pale slaty.

3. San Francisco specimens (called "*Vancouverensis*") are darker yellow than the last, with no central or dark stripe. They thus agree closely with the description of the animal of *A. concava* by Dr. Binney, but differ much from that of Oregon *Vancouverensis* as described by him and by Dr. Newcomb, in Amer. Journ. of Conch. Vol. I.

The animals of Alaska specimens, with a greener shell, are paler than all the others.

M. Durantii Newc. = *Patula Durantii* of former papers. According to Bland & Binney this little species shows the same disregard for generic uniformity of size seen in *Patula*, *Zonites*, *Hyalina*, etc., and makes the terminal member of the series on this coast represented by three or four species, regularly diminishing in size.

I have lately found it in one spot (on limestone only), two miles from Oakland, so that its name, from the late President of the University of California, is more appropriate than when given (see these Proceedings, III,

118). It was also found several years ago by Mr. Rowell, at Haywards, also in Alameda Co. I have not found it there, where, however, occur the following mollusca: *Helix Californiensis*, typical, *H.* (var.) *infumata*, *Triodopsis loricata*, *Mac. concava*, and all the species without shells common to California.

Punctum pygmæum Drap. This most minute of our species has lately been found, also, near Haywards, by Dr. Yates.

Succinea lineata W. G. Binn. The specimens from Mojave River mentioned by me in Vol. IV, p. 151 as probably *S. rusticana* Gld., are more likely to be *lineata*, as I found this west of the first locality along Santa Clara River, down to within 8 m. of San Buenaventura. The animal is yellowish-white, paler beneath, eye-tentacles dark, with a dark line running back in the animal's head from each. Shell honey-yellow, thick enough to hide the colors of animals.

S. Sillimani Bland. The Mojave R. specimens mentioned with the above as *S. Nuttalliana* Lea, are probably the present species for the reason just mentioned, this having been found by me in the same swampy thickets. The animal is quite different from that of the last, being lead-color, paler beneath, but showing also the dark lines in and behind tentacles. The shell is greenish, and so thin that the viscera show through it, but is nearly always so encrusted with mud as to partially conceal it. I have noticed the same habit in *S. Stretchiana*, the mud being evidently plastered on in ridge-like layers by the animal itself.

Hyalina arborea Say. Not rare with the *Succineas*, the only place where I have found it near the level of the sea in Southern California. Constant moisture and summer fogs, are found in few other locations southward.

Genus Prophysaon Bland & Binney, 1873, type "*P. Hemphilli*" B. & B., Ann. N. Y. Lyc. X, 293-297, Pl. XIII.

The authors remark that they had only compared alcoholic specimens with my description and figure of "*Arion Andersonii*" (Proc. Phil. Acad. 1872, 148, pl. III, f. F). I have compared *their* description and figure with alcoholic specimens of my species, and find that the differences mentioned by them are caused chiefly by the contraction by the alcohol. The distinct locomotive disk, minute caudal pore, and position of generative orifice, all become changed as described by them. The jaw figured by them differs only in being immature, and in some of the ridges being consolidated, thus showing eight single and six double ones, making twenty, as given by me.

This difference, with other possible distinctions in color in fresh specimens, may be sufficient to separate their species by the name of *P. Hemphilli*. Mine is, however, of the same genus, and though I had before suggested a name for it in Mss., I am willing to adopt *Prophysaon Andersonii*. It is not unlikely that the Oregon animal may be the "*Arion foliolatus*" Gld., still imperfectly known. My species is common in winter along the large creeks east of San Francisco Bay.

Ariolimax Californicus Cp. In the dry season these animals crawl down into deep fissures made by the sun in some soils, or hide on the northern exposure of cañons on streams, in cellars, etc., where some can be

found all summer within ten to twenty miles of the coast. At a place near Oakland where the kitchen-refuse of part of the town is dumped, near a swampy spot, they come out in hundreds to feed on the rotten vegetables, etc., emerging about 4 P. M. up to June, when fogs prevailed, but not until sunset in August. A few *L. campestris* inhabit the same spot, but remain in the wet grass only.

A. niger Cp. This, described with *P. Andersonii*, I have since found once near Cypress Point, Monterey, as well as in several places within the range given before. Near Oakland it does not appear until the ground is well soaked with rain, about November, and deposits its eggs in December to February. It does not occur in gardens, but in uncultivated oak-groves on clay lands.

"A. Hemphilli W. G. Binn., lately described from Niles Station, Alameda Co., seems externally only like a pale var. of *A. niger*.

Limax (Amalia) Hewstoni Cp. In our Proceedings IV, p. 151, 1871, I referred to this as "another new species of *Limacidæ*," being uncertain whether it might not be imported, as I found it only in San Francisco. It certainly agrees nearly with the too brief description of *L. Sandwichensis* as well as the figure, in Voyage of the Bonite, II, p. 497, Pl. 28, f. 8, but comparison of living specimens will be necessary. Mr. Binney in Ann. N. Y. Lyc. XI, 22, states that specimens of an *Amalia* were sent to him by Mr. Hemphill from Los Angeles, and though differing in its dentition, thinks it indicates that the genus is native to California. I am more inclined to think some species has also been introduced there with orange trees, grape vines, or otherwise.

My reason is, that I have searched carefully for these animals in Southern California since 1871, and found only *Limax campestris*, which is common near San Buenaventura, and occurs south to San Juan Capistrano, while I found none in the mountains or valleys near San Diego, and no *other* one at Los Angeles.

This species has apparently succeeded in establishing itself in spots on the east side of S. F. Bay, where the climate is much drier than in the city. I have found it only in one very damp garden in Oakland, and in some 12 miles east of there, while outside of cultivated gardens, even where always moist, it does not occur.

Alexia (myosotis var.?) setifer Cp. Since my first notice of this species, it has been nearly exterminated in Mission Creek, by street crossings and obstructing the tidal flow, so that I have lately found it only in one spot near the mouth. It may, however, remain more scattered in Mission Bay, though so exceedingly tender that it has died in every other locality where I have tried to colonize it. The name given in Vol. V, p. 172, as "*Melampus ciliatus*" should be Auricula ciliata *Moricand*.

Ancylus crassus Hald? A specimen received from Humboldt River, Nev., by Dr. Yates, appears to be a thin variety of this, approaching "*A. Kootaniensis*" Baird, and thus connecting the latter with former, as I doubtfully placed them in these Proceedings, IV, 101, 1870.

On p. 174 of same volume, I referred specimens from Spokan River to *A. patelloides* Lea, by mistake for *A. crassus*.

Gundlachia Californica Rowell. Two specimens found by me in a little sandy rivulet at Baulines Bay, appeared to be merely the common *Ancylus fragilis*, but some months after, in taking out the animal, I found that one had a "deck" covering nearly its whole aperture, exactly as in the "young of *G. Stimpsoniana*" figured by S. Smith in the Ann. N. Y. Lyc. May, 1870. The other, though exactly similar above, is an *Ancylus* below! That from Merced Falls, mentioned in our Vol. IV, p. 154, differs in being much smaller and paler, as were the *Ancyli* found with it. Mr. Smith states that the animal of his was exactly like that of *Ancylus fuscus*, and Dr. Stimpson described the dentition as similar also, to that of *A. rivularis*. These facts seem to show that the forms called *Gundlachia* are only modifications of *Ancyli*, analogous to the thickening of lip observed in Physas that survive a winter or a dry season. Some individuals, better nourished than others, secrete so much shell as to nearly enclose themselves in their first year's shell. In the following year they may continue to form shell, and thus make a *two-storied Gundlachia* from a one-storied *Ancylus*. Thus we see why the specimens of the former so much resemble those of the latter found with them, in the respective localities of each so-called species.

Limnophysa Binneyi Tryon. Many specimens of this fine species were found by Mr. Dunn at the Cascades of the Columbia, with a *Physa*, apparently a large var. of *P. diaphana*.

Pomatiopsis intermedia Tryon. Found once near Clear Lake by Dr. Yates, and by me in a small spring near Saucelito, Marin Co., the last proved by the animal.

Bythinella Binneyi Tryon. I have found what I suppose to be this near the summit of "Black Mountain," Santa Clara Co., over 1,500 ft. alt., in a cold mountain rivulet. Others from branches of Alameda Creek found by Dr. Yates, differ entirely in the animal from that of *Pomatiopsis*, but it externally resembles closely that of *Amnicola*, of which this is scarcely more than a subgenus.

Cochliopa Rowellii? Tryon. Two fossil specimens from post-pliocene beds near Green Valley, Contra Costa Co., are so much like this species, as figured, that it may still exist in California, even though found at Panama also, as Mr. Tryon believes, from specimens received. Several Central American fresh-water shells seem to be identical with the northern, and a Tropical American *Pompholyx* is described as closely resembling that of California.

Hydrobia Californica Tryon. After long search I have found specimens of a true *Hydrobia* in a very limited station at the head of a brackish creek on the south side of "Lake Peralta," Oakland, where they occur on floating sticks. The shell described by me in Proc. Acad. Sc. Phil. 1872, as *Assiminea Californica* "Tryon," and mentioned in these Proceedings,

IV, 173, is quite distinct, and inhabits the outlet of the same creek abundantly, ¼ mile lower down. They must be distinguished as follows:

A. Californica Cooper (Tryon in part?). Dark horn-brown, shining, acute, whorls rapidly increasing, and flattened on spire, a slight parietal callus, not connecting lips. Animal whitish, tentacles and muzzle tinged black, a rufous patch on top of head, its foot ovate, twice as long as shell; tentacles oculiferous, two.

H. Californica Tryon (emend., figure and part of description). Shell nearly white, translucent, rough, rather obtuse, whorls slowly increasing, and very convex, mouth subovate, lip nearly continuous, leaving a slight notch in umbilical region. Animal white, top of head and tentacles (four) yellowish, a black jaw (?), visible in proboscis. which is very extensible; foot with pointed lateral lobes in front spreading sideways, tapering to a long acute point behind, tentacles long and sharp, the eyes at their base; foot 1½ times the length of shell—proboscis half its length, tentacles about as long.

The animal of *Hydrobia* is much more active than that of the former, and easily observed in a bottle of water taken from its peculiar station.

Regular Meeting, February 15th, 1875.

The President and Vice-Presidents being absent, Mr. Stearns was called to the chair.

Eighteen members present.

Donations to the Museum: From Mrs. F. F. Victor a collection of shells from Modoc Lake, on the northern border of California. Henry Hemphill donated sundry reptiles and crustaceaceæ, (not identified); from W. Russel a mole-cricket; from Dr. Kellogg a specimen of *Pinus muricata* from Santa Cruz, illustrating the enlarged umbos when much exposed to the winds of the coast, also cones of *Pinus monophylla*, one of the most nutritive and delicious of all the piñones. From F. Gruber, the following birds: *Perdix cinerea*, or European Field Partridge; *Ampelis garrulus*, or wax wing; *Alauda brachydactyla*, or Crossbill; *Fringilla Coccothraustes*, or Grosbeak; *Oriolus galba*, or Golden Oriole.

The Secretary read a paper from Professor George Davidson, as follows:

Abrasions of the Coast of Japan.

BY GEORGE DAVIDSON.

In approaching the coast of Japan on the voyage from San Francisco, there is opportunity for seeing but a very few miles near the southern eastern point of the entrance to to the Gulf of Yedo. This we made before daylight, and so far as I could make it out, there was no feature resembling the well marked terraced points and capes met with on the northwest coast of North America.

The surface features of the coast are nevertheless well marked and distinctive, reminding one of parts of the Pacific coast of Mexico, and of parts north of latitude forty, except the absence of the heavily timbered slopes and summits. On the coast of Japan the hills rise steeply to elevations reaching two and three thousand feet, and are either cultivated or covered with a dark green chapparal, with occasional limited masses of small timber. There are no indications of broad deep valleys, but mostly of short narrow valleys with sharply sloped sides.

After entering the Gulf of Yeddo the only terraces I could detect are at Cape Canon, on the western side about twelve miles south of Yokohama, and at a the part of the Gulf where a moderately sharp contraction of the width of the Gulf takes place. At this point are exhibited some of the characteristics of the terraced points off our Pacific Coast. The coast-line is of quite recent formation; the stratification somewhat distorted, and has a moderately large inclination; but the surface of the contracted terraces is parallel with the sea-level, and has evidently been planed off by the Glacier which moved along the face of the sloping higher land. On the surface of these terraces lies a thin layer of soil which is cultivated.

Upon leaving Yokohama for Nagasaki I had another opportunity of examining this terrace and confirming my previous judgment. Thence to Oō Sima, the coast line was passed in the night time until we made Ise Bay, where the high, broken and dark outline of the coast hills is seen. Every hillside is covered with dark green chapparal and small timber; the hills reach two thousand feet elevation and give no indications of extended valleys. Skirting along this coast in moderately thick weather we saw no terraced shores until we neared the promontory off which lies the island of Oō, with its lighthouse, in latitude 32° 25′. Here were unmistakable evidences of terraced coast line, not in one or two cases, but for miles to the northeast of Oō Sima (*a*), and especially in the island itself. The single terrace of this island is very well marked parallel to the sea-level, and is about 100 feet above the water. When abreast of it several slightly projecting terraced points are seen along the coast to the northeastward, and also on the coast immediately abreast of the island. But I did not see the terraced lines along the north-

(*a*) Sima = Island.

west coast line of this promontory, even in the vicinity of Oō Sima. Bad weather and night shut in further opportunity.

This promontory forms the eastern shores to the eastern entrance to the great strait, called the inland sea of Japan, through which we passed for two hundred and fifty miles, enjoying some of the most enchanting views I have ever seen, reminding me forcibly of the great inland waters from Puget Sound to the Chilkaht River, but enlivened by hundreds of junks and fishing vessels; shores lined with villages; steep hillsides terraced for cultivation to heights of nearly one thousand feet, wherein the numerous terrace walls would certainly form a total height of four hundred feet, as I have verified here. Some of the passages are tortuous, narrow and deep—through high islands or between steep fronted capes. Cultivation on every spot where even five hundred square feet and less can be terraced. No heavy timber; sparsely distributed patches of small timber; large growth of chapparal on the higher and steeper parts of the hills. The mountains rise to elevations of probably 3,000 feet, but the average height of the outline will be about one thousand feet. Again no indications of valleys except of the most limited character.

I looked in vain through all these shores for signs of terrace formation. So along the outer coast and through the islands from Simonoseki strait to Nagasaki, the hills preserved their characteristic outlines and shapes, except Table Mountain, fifteen hundred feet high and lying a few miles west of Nagasaki.

Here I have had ample opportunity to judge of the general geological character of the country. It is of the most recent formation, has been violently distorted by pressure from below, and then eroded into its present irregular surface. I have looked occasionally for local traces of glacial action in some of the harder materials, but failed to satisfy myself beyond doubt.

But of the glacial action at Cape Canon, and at Oō Sima, and the adjacent coast, I have no doubt whatever; but in both cases I could trace but one terrace, and that at Oō Sima had an elevation of one hundred feet.

I have communicated this short note to the Academy as an additional evidence to what I have already given of the abrasions of coast line by the action of glaciers bordering them.

The Secretary also read a paper from Professor Davidson, as follows:

Note on the Probable Cause of the Low Temperature of the Depths of the Ocean.

BY GEORGE DAVIDSON.

In my first note upon the "Abrasions of the Continental Shores of Northwest America, and the supposed Ancient Sea Levels," I attributed these abrasions to the action of a great body of ice contiguous to the whole line of our coast, and which moved along the coast line either by the combined forces

of ocean currents and the pressure of the greater masses from the northward; or as part of the great ice sheet that covered the continent and moved slowly southward.

As a glacial mass it extended seaward many miles, as indicated by its action upon the islands which I therein named. And it seems not only possible, but highly probable, that this great ice sheet not only covered and bordered the continent, but that it projected far into the oceans; *and not improbably may have occupied a large part thereof!*

We know its effect in the terracing of the rocky coast of Northwest America; and in cutting the channels through the Santa Barbara Islands; and still further, I believe we see other *effects of its existence and extent in the present nearly ice-cold temperature of the great depths of the ocean!*

The theory which attempts to account for that low temperature by the transfer of Arctic waters to the depths of ocean utterly fails in the case of the Northern Pacific Ocean, where the narrow contracted throat of Behring Strait not only could not give egress to such a volume of cold water in millions of years, but is actually the channel for the passage of the Kamschatka branch of the Japan warm stream into the Arctic basin. A small thread of the Arctic waters does pass through Behring Strait, but it is of very limited section, for the strait itself has a section of only thirty miles in width by twenty-five fathoms in depth.

The more that I have looked at the discussions of the theory of the intercharging heated surface waters of the equatorial regions with the cold waters of the Arctic basin, the more strongly I am convinced of its weakness and insufficiency. And in searching for the cause of the nearly ice cold waters of the ocean depths, the proved former existence of the great ocean coast ice belt, and probably of ice masses occupying the high northern and southern areas of the oceans, have seemed to me sufficient to account for the low temperatures which deep sea explorations have proven to exist.

Dr. Kellogg read a paper describing the different varieties of Eucalyptus, with their characteristics.

Different Varieties of Eucalyptus, and their Characteristics.

(Letter to Mr. Ellwood Cooper, of Santa Barbara.)

BY DR. A. KELLOGG.

According to promise, I collate a few brief notes on *Eucalypti.** As you have Dr. Mueller's work I need not quote from it, but give such information as can be obtained from other sources. For the medical properties of extracts, etc., I refer you to the Doctor.

I wish to say, first, that I know of but *two trees* (which now occur to me) that are perfectly proof against the *Teredo navalis*, or pile-borer of tide water,

* There are one hundred and thirty-five species. A long time may elapse before a thorough knowledge of these and their numerous varieties are fully known.

or their like. These are the Palmetto (*Chamærops palmetto*) of our southern coást, and the Yarrah of Australia. There are doubtless many more. (?)

If at any time you visit the city, we shall take great pleasure in showing specimens of timber that have been tested, now in the collection of the California Academy of Sciences (of which your correspondent is Director in charge). So that no one need take second-hand opinions, or the *Ipse dixit* of any one writer, author, or personal friend. This much is due, by way of introduction. And further, we need to be cautioned against considering that any one knows it all. Much experience and careful experiment is yet requisite; I trust, however, that thorough tests of all timbers, native and cultivated, will, ere long, be made, either at our State University or the Academy.

If I am right, the common *Eucalyptus globulus* (of which you cultivate so much) is not an Australian Gum at all, but Tasmanian—New Zealand has none; if wrong in this impression, I will write again. *E. globulus* is greatly infested by beetle borers when transplanted into parks in Australia. We have a specimen badly eaten by the *Teredo*, but the card attached omits to name the species.

E. rostrata.—This is the famous Yarrah (or by corruption, Jarrah of some. It should be noted that this name is applied by the natives, and vulgarly, to almost any tree). This specimen is also called Flooded Gum, Red Gum, or White Gum—described as a striking object on the landscape—so wild and picturesque; its huge, gnarled or coiled branches—shining bark of white or light red—contrasting with dark masses of foliage above, and glancing shadows below, produce peculiar scenic effects of the wildest forests, awakening the ideas of grandeur, as the lofty object lifts its signal flags high over all the trees; inspiriting the thirsty, weary and worn traveller from afar with the living assurances of water.

This is the true species that has proven so perfectly proof against the white ant and beetle borèrs; and altogether impervious to the *Teredo* that infests the piles of our wharves. A specimen of this timber, presented by Mr. I. C. Woods of this city, has stood the best of actual trial, as here seen.

This is also largely used for railway ties, etc. The wood is solid as iron; specific gravity 0.858 to 0.923 or variable, and does not always bear so good a character—climate, soil, etc., have much to do with the quality of this and all timber, as we know full well. A large tree, along streams or adjacent to water.

E. tereticornis.—Called Gray Gum, often Red Gum or Blue Gum, and sometimes Bastard Box—a very variable species. Flowers generally seven in a cluster; seed box has a broad rim, the valves protruding. The wood is good for posts and rails, or as fuel—has a beautiful grain like oak—takes a fine polish, and whether exposed or not is durable. Used where the Iron Bark cannot be had.

E. punctata.—This is mostly termed Hickory or Leather Jacket; has rather spreading habit; is exceedingly tough and durable; fine for fencing, railway sleepers, and for fuel. The rim of this seed-vessel is not so broad, nor valves so prominent; there are several varieties.

E. Stuartiana var. *longifolia*, is the Yellow Gum; seldom 80 feet high; timber good; leaves very long; valves of seed-vessel not so prominent as the preceding;

wood only used for fencing or fuel; decays rapidly if exposed; easily killed by a wet season.

E. viminalis.—This is the Manna; also Drooping; called also White Gum; yields manna, and is *remarkable for its elegance;* 150 feet high, 8 feet diameter; not much esteemed. The Gray Gum (*E. saligna*) sometimes mistaken for this, etc.

E. dealbata is one of the so-called White Gums, about 50 feet, without branches, capped with dense foliage, covered with a white powdery bloom (easily rubbed off): bark of a purplish tinge when young, becoming brown with age; wood light color, too soft to be of general use; said to shed its bark every third year.

E. albens is also one of the White Gums; 80 feet high, etc.; wood of little or no use.

E. goniocalyx is one of the most useful; in some districts called Flooded Gum; in others, Blue Gum; chiefly found on rivers and creeks, and is also a forest tree. One mark of this species is the angular calyx—hence specific name; another, the short, flat peduncles (flower-stems) in umbels or clusters of seven flowers on short, thick stems; 80 feet or more, 7 feet diameter. Although the wood varies with soil, it is generally considered highly valuable; several of the Blue Gums of catalogues belong to this species; a tree of rapid growth; specific gravity less than that of any other Gum. The timber is extensively used for building purposes, as scantling, battens, floors, posts and rails, ship's planks, etc. Indicates good soil.

E. dumosa—the big chaparral bush so annoying to travelers.

E. incrassata is another of the small species that together constitute the Mallee Scrub; the natives sharpen and harden in hot embers for digger sticks, like metal; famous for ramrods, etc.

E. uncinata is Dr. Mueller's *E. oleosa*—still another of the above list of Mallee Scrub; the root runners retain a copious supply of pure water for the thirsty.

E. hæmastoma—Mostly known as White Gum, but in some districts the bark has gray patches; hence known as Spotted Gum; little esteemed for fuel or any other use.

E. stellulata—This is the Mountain White Gum; in some districts the bark is lead-colored, hence named Lead Gum; 30 to 40 feet high, and 2 feet diameter; wood of no service, save for fuel; distinguished by veins or nerves that start near the base of the leaves, and run almost parallel to the midrib.

E. coriacea—This is another of White Gums from the Blue Mountains; 40 to 80 feet; not much valued.

E. radiata—The River White Gum (by some considered a variety of the Messmate or *E. amygdalina*). This is a smooth tree with bark often hanging in long strips from the upper branches; it never grows away from water; 50 to 60 feet; timber not valued by the settler.

E. eugenioides—The Mountain Blue Gum; 100 feet high, and much used by wheelwrights and carpenters, but is not equal to *E. goniocalyx*, the Flooded or Blue Gum.

E. gracilis is Dr. Mueller's *E. fruticetorum*; a small tree or shrub of several varieties.

E. Saligna a Gray or Flooded Gum of rather drooping habit and no great size; in low grounds, *near salt water;* although a fine looking tree, sometimes 100 feet in height, the wood is inferior.

E. maculata or Spotted Gum is one of the handsomest; 100 feet and upwards; well defined by its double lid and urn-shaped seed-vessel; some esteem it equal to the English oak, others regard it as fire-wood; used for staves and upper parts of railroad bridges, etc.; grows in poor soils, New South Wales and South Queensland.

E. virgata—Styled Mount Ash (this name, I see, is given to *E. amygdalina* or Messmate in the Government Report of the Secretary for Agriculture of 1874). This is a fine tree, 120 feet high, growing on rocky mountain ridges; makes better staves, good shafts, and all common carpenter work, fences, etc.

E. obtusiflora—An inferior kind of Box or Blackbut; has large flowers, and an ovid blunt seed-vessel; the wood is valueless.

E. pilularis or Blackbut of South Queensland, Gipps Land and New South Wales, is one of the largest and most valuable species of the Gums. A tree of over 46 feet circumference 5 feet from the butt; 150 to the first limb. The wood is excellent for house carpentry, ship building, and, indeed, for any purpose where strength and durability are required; specific gravity 0.897: no species known bears a greater crushing strain in the direction of its fibre; it prefers good soil, and grows rapidly.

E. acmenoides, or White Mahogany, is remotely allied to the above.

E. Bicolor comprises several varieties, called Bastard Box or Yellow Box; this resembles the narrow-leaved variety of Iron Bark; has grey and white patches, hence the specific name; 80 to 100 feet high; when young, smooth above, or half-barked like the Box; older, nearly all the bark falls off; the wood is very hard, good for fencing, shafts, poles, cogs, etc.; exceedingly durable; heavy, but does not split well; as it does not sun-crack, it is esteemed for spokes, weather boards, etc.

E. hemiphloia is the well-known Box. In first-class repute for hardness, toughness and durability; burns brilliantly, and emits great heat, but it is attacked in the ground by dry rot and the white ant; specific gravity, 1.129; shafts, spokes, plough-beams, etc.

E. longifolia, usually called Wooleybut, though in some districts called Peppermint,* on account of the oil of the leaves having that flavor. A very fine tree, with leaves more than a foot long; flowers large, in 3s; seed-vessels best defined of all, ¾ inch long, ½ in diameter, four-celled, valves not protruding beyond the broad oblique rim. The volatile oil of the leaves possess remarkable qualities, but the wood is not much esteemed, save as fuel; it is, however, split for fencing and the like, but not durable; others say excellent; the fibre of the bark is adapted for packing and paper making.

E. diversifolia—A tree of beautiful form, 80 feet high; wood indifferent; buds and seed-vessels small, eight, in axillary or lateral umbels.

E. polyanthemos is a tree of moderate size called *Lignum Vitæ*, Poplar-leaved Gum, or Bastard Box; wood brown towards the centre; very hard and tough.

E. pulverulenta and *E. cinerea*—Two varieties of small tree called Argyle Apple (being similar to *Angophora subvelutina*, or Apple of the Colonists).

E. acmenioides or the White Mahogany; often mistaken for the Stringy Bark (*E. obliqua*, capitella, etc.), but the bark is not so fibrous, nor the leaves so oblique, whilst the specific gravity of the wood is much greater; found near the coast; timber useful for building purposes, palings, etc.; when nicely planed, has an ornamental appearance.

E. robusta is the Swamp Mahogany, a very large tree; over 100 feet, and 5 diameter; in low marshy places; seed-vessel more than one-half an inch long, the capsule deeply sunk; in young trees the leaves are large and glossy. The wood is not considered durable, though people differ in opinion; used for rough furniture and inside work, ship-building, wheelwrights, and for mallets, etc.

E. botryoides is the Bastard Mahogany of workmen; it grows in sandy places near the sea. A tree of gnarled and crooked growth of no great height; used for fuel, knees, etc., of vessels.

E. resinifera, often called Red and Forest Mahogany; the first name is taken from the color of the wood, the other from being found in forests remote from the coast. The wood is very strong and durable, and is used extensively for fencing, beams, rafters and rough work; specimens of sound wood that had been fifty-four years in a church were taken down and sent to the Paris Exposition.

E. corymbosa, or Bloodwood, from the color of the resin that exudes from between the concentric circles; inland species; 120 feet; for fences and firewood; of rapid growth; the wood is soft, especially in young trees; becomes

* This we take to be the far-famed fire-proof shingle tree; sparks can only burn a hole through, but it will neither flame nor spread; splits to a charm.

harder in age; said to stand well in damp ground; some affirm its great strength and durability; seeds winged.

E. eximia is the Mountain Bloodwood; Bentham thought this species more nearly allied to *E. maculata* or Spotted Gum than to Bloodwood; flowers large, corymbose; the operculum or lid is double, the seed-vessel is urn-shaped, nearly an inch long; top of capsule deeply sunk.

E. stricta is a shrubby species; fine linear leaves; forms thick brushes; it is the *E. microphylla* of Cunningham.

*E. dives** and *E. piperita* are two of the Peppermints; the first has small, and often opposite leaves; the latter very large, like a Stringy Bark, but not so thick, nor are they so oblique at the base; flower-buds smaller; lid more hemispherical and sharper at the point, whilst the seed-vessel is more globose; but they vary from Mountain Ash (*E. radiata*) in bark and habit; 5 to 15 feet diameter; 200 feet of clear shaft, etc.

E. melliodora, the Red Flowering or Black Iron Bark; flowers ornamental; delicious honey-like odor, as the name indicates; 60 feet; timber in quality variable.

E. panniculata, and *E. cerebra* (one species), are mere varieties of the White Iron Bark, one of the most valuable trees; specific gravity, 1.016; the breaking weight of a transverse strain of a beam four feet between bearings 1⅞ square, 4,519 lbs.; best of all the Iron Barks; a smooth, uniform outer bark; hard, tough, inlocked strong wood; highly esteemed by coach-makers and wheelwrights for poles, shafts, etc., of carriages, spokes of wheels; also largely for piles and railway sleepers; 150 feet high by 16 feet diameter; both of these are united into one species.

E. siderophloia is the Red or Large-leaved Iron Bark, formerly described as *E. resinifera*; this yields the brown gum or Botany Bay Kino (inspissated juice). The wood though not so tough as the preceding, is considered one of the strongest and most durable of timbers. There are two varieties; both vary from 80 to 120 feet, distinguished by the bark, which is darker color than the *E. panniculata* or White Iron Bark, and the leaves are more uniformly larger.

E. melanophloia is the Silver-leaved or Broad-leaved Iron Bark; a taller tree than the other Iron Barks, and readily known by its stemless or sessile opposite leaves, which are glaucous or mealy white.

E. obliqua, *E. capitella* and *E. macrorhyncha*—Hon. Wm. Woolls, F. L. S. (from whom we collate), considers them all as forms of the Stringy Bark, only varying with climate, soil, elevation or proximity to the sea, etc.; rises to 100

*It is possible this may be the *Shingle tree* (?) of a previous note.

or 120 feet; some of these woods are reported as excellent for house-carpentry, whilst others were inferior; 300 to 400 feet high; the bark makes packing, printing, and even writing paper; also good for mill and paste-boards; the pulp bleaches readily; forms the main mass of forests of the more barren mountains; the thick bark has also been successfully manufactured into door-mats, cheap fences, palings, shingles and wood-work.

E. amygdalina or Almond-leaved Eucalyptus, or Messmate, is like the Stringy Bark, but the upper branches are smooth; 200 feet high; wood not much valued; a hard tree for the settlers to kill, it is so irregular at the base; wood folded or deeply indented, forming clefts or "pockets" so that they cannot ring, belt or girdle the tree to advantage, for they fail to reach all the bark of these hollows. In the Messmate the leaves are not so thick as in the Stringy Bark, nor are they so oblique at the base; flower-buds are smaller; lid more hemispherical, and its point sharper, whilst the seed-vessel is more globose; but they vary from *E. radiata* in bark and habit; 5 to 15 feet diameter, with 200 feet of clean shaft.

Dr. Mueller's scientific work abounds in varied information; but collations from that work are omitted to avoid repetition. For medical and manifold uses see his work.

P. S.—As Dr. Mueller's "Additions to the List of Principal Timber Trees, etc." (Issued 1871-2, by the Victorian Acclimatization Society) is not accessible to many, we extract the following:

E. botryoides, Smith. From East Gipps Land to South Queensland. One of the most stately among many species, remarkable for its dark green shady foliage. It delights on river banks—80 feet without a branch, diameter of 8 feet. Timber usually sound to the center; water work, wagons, knees of boats, etc., for posts very lasting, as no decay was observed in 14 years.

E. brachypoda, Turc. Widely dispersed over the most arid tropical and extra-tropical inland regions of Australia. One of the best trees for desert tracts; in favorable places 150 feet high. Wood brown, sometimes very dark, hard, heavy and elastic, prettily marked, used for cabinet work, but more particularly for piles, bridges and railway sleepers. (Rev. Dr. Woolls).

E. calophylla, R. Brown. S. W. Australia. More umbrageous than most Eucalypti, and of comparatively rapid growth. The wood is free of resin when grown on alluvial land, but not so when produced on stony ranges. Preferred to *E. marginata* and *E. cornuta* for rafters, spokes and fence-rails—strong and light but not lasting long underground. Bark valuable for tanning, as an admixture to *Acacia* bark.

E. cornuta. S. W. Australia. A large tree of rapid growth, prefers a somewhat humid soil. Used for various artizan work, preferred for strongest shafts and frames of carts, and work requiring hardness, toughness and elasticity.

E. crebra, F. V. Mueller. The narrow-leaved Iron Bark of N. S. Wales and Queensland. Wood reddish, hard, heavy, elastic and durable; for bridges much in use, also for wagons, piles, fencing, etc. *E. melanophoia*, (F. V. M.) the silver-leaved Iron Bark; *E. leptophleba: E. trachyphloia* and *E. drepanphylla* are closely allied species of similiar value. They all exude astringent gum-resin in considerable quantity, like Kino in appearance and property.

E. Doratoxylon, F. V. M. The spearwood of S. W. Australia. In sterile districts. The stem is slender and remarkably straight, wood firm and elastic; nomadic natives wander far to obtain it for their spears.

E. eugenioides, S. N. S. Wales. Regarded by the Rev. Dr. Woolls as a fully distinct species. Its splendid wood, there often called Blue Gum tree wood, available for many purposes, and largely utilized for ship building.

E. goniocalyx, F. V. M. From Cape Otway to the southern parts of N. S. Wales. A large tree, which should be included among those for new plantations. Its wood resembles in many respects that of *E. globulus*, proved a valuable timber for house building, fence rails, etc.

E. Gunnii, J. Hook. At Alpine and sub-Alpine elevations.

The other more hardy Eucalypts comprise *E. coriacea*, *E. E. alpina*, *urnigera*, *E. coccifera*, and *E. vernicosa*, which all reach heights covered with snow for several months in the year.

E. Leucoxylon, F. V. M. (*E. sideroxylon*, syn.) The common Iron bark of Victoria. Some parts of S. Australia and N. S. Wales. As this durable timber is falling short, and for some purposes superior to almost any other Eucalypt, its culture should be fostered, especially as it can be raised on stony ridges of little use. The wood is pale, sometimes dark. The tree restricted generally to the lower silurian sandstone and slate, with ironstone and quartz. It is rich in Kino.

E. Phœnicea, F. V. M. Little is known of the timber, but the brilliancy of its scarlet flowers should commend it to extensive culture. For the same reason also *E. miniata* from North Australia, and *E. ficifolia* from S. W. Australia. Carpenteria and Arnheim's Land.

E. platyphylla, F. V. M. Queensland. One of the best shade trees. Rev. Mr. Woods saw leaves 1½ long by 1 foot wide. Thrives in open or exposed localities.

E. tesselaris, F. V. M. N. Australia and Queensland. Furnishes a brown, rather elastic wood, not very hard, available for varied artizan work, staves, flooring, etc. Exudes much astringent gum-resin.

Mr. Stearns made some verbal remarks concerning Dr. Kellogg's paper, and mentioned the proper and improper methods of transplanting the young trees.

Mr. Stearns also called the attention of the Academy to the peculiarities of certain young trout in the hatching troughs at Berkeley. Some of the fish which were hatched from eggs brought from the Eastern States by rail, were double—some two heads and one tail, and others were distinctly formed but joined together by a filmy substance.

A letter was read from Prof. D. C. Gilman, President of the University of California, inviting the members of the Academy to hold a session at Berkeley on Monday, February 22d.

The invitation was accepted, and the Academy adjourned to meet at Berkeley on Monday, February 22d, at 11 A. M.

Special Meeting at Berkeley, February 22d, 1875.

Henry G. Hanks in the Chair.

Mr. Stearns, in behalf of the Academy, made some remarks to those present, reminding the members that the Academy must depend mainly upon the University to fill its ranks as time thinned it of its pioneers.

Professor Joseph LeConte read the following paper, the result of original investigations near Lake Tahoe:

On some of the Ancient Glaciers of the Sierra.

BY JOSEPH LE CONTE,

Professor of Geology of the University of California.

II.—Some of the Tributaries of Lake Valley Glacier.

Last summer I had again an opportunity of examining the pathways of some of the ancient glaciers of the Sierra. It will be remembered, by those interested in this subject, that two years ago I published a paper with the above title.* One of the grandest of the glaciers there mentioned was one

*Am. Journal, Ser. III, Vol. 5, p. 125. Proc. Cal. Acad. Sciences, Vol. IV, part 5, p. 259.

which I called *Lake Valley Glacier*. Taking its rise in snow fountains amongst the high peaks in the neighborhood of Silver Mountain, this great glacier flowed northwards down Lake Valley, and gathering tributaries from the summit ridges on either side of the valley, but especially from the higher western summits, it filled the basin of Lake Tahoe, forming a great mer de glace, 50 miles long, 15 miles wide, and at least 2,000 feet deep, and finally escaped northeastward to the plains. The outlets of this great mer de glace are yet imperfectly known. A part of the ice certainly escaped by Truckee Cañon, (the present outlet of the lake); a part probably went over the northeastern margin of the basin. My studies during the summer were confined to some of the larger tributaries of this great glacier.

Truckee Cañon and Donner Lake Glaciers.—I have said that one of the outlets of the great mer de glace was by the Truckee River Cañon. The stage road to Lake Tahoe runs in this cañon for fifteen miles. In most parts of the cañon the rocks are volcanic and crumbling, and therefore ill adapted to retain glacial marks; yet in some places where the rock is harder these marks are unmistakable. On my way to and from Lake Tahoe, I observed that the Truckee Cañon glacier was joined at the town of Truckee by a short but powerful tributary, which, taking its rise in an immense rocky amphitheater surrounding the head of Donner Lake, flowed eastward. Donner Lake, which occupies the lower portion of this amphitheater, was evidently formed by the down-flowing of the ice from the steep slopes of the upper portion near the *summit*. The stage road from Truckee to the summit runs along the base of a *moraine* close by the margin of the lake on one side, while on the other side, along the apparently almost perpendicular rocky face of the amphitheater, 1,000 feet above the surface of the lake, the Central Pacific Railroad winds its fearful way to the same place. In the upper portion of this amphitheater large patches of snow still remain unmelted during the summer.

My examination of these two glaciers, however, was very cursory. I hasten on, therefore, to others which I traced more carefully.

As already stated in my former paper, Lake Tahoe lies countersunk on the very top of the Sierra. This great range is here divided into two summit ridges, between which lies a trough 50 miles long, 20 miles wide, and 3,000–3,500 feet deep. This trough is Lake Valley. Its lower half is filled with the waters of Lake Tahoe. The area of this lake is about 250 square miles, its depth 1,640 feet, and its altitude 6,200 feet. It is certain that during the fullness of glacial times this trough was a great mer de glace, receiving tributaries from all directions except the north. But as the glacial epoch waned—as the great mer de glace dwindled and melted away, and the lake basin became occupied by water instead, the tributaries still remained as separate glaciers flowing into the lake. The tracks of these lingering smaller glaciers are far more easily traced, and their records far more easily read, than are those of the greater but more ancient glacier of which they were but once the tributaries.

Of the two summit ridges mentioned above, the western is the higher. It bears the most snow *now*, and in glacial times gave origin to the grandest

glaciers. Again: the peaks on both these summits rise higher and higher as we go toward the upper or southern end of the lake. Hence the largest glaciers ran into the lake at its *southwestern* end. And, since the mountain slopes here are towards the northeast and therefore the shadiest and coolest, here also the glaciers have had the greatest vitality and lived the longest, and have, therefore, left the plainest record. Doubtless, careful examination would discover the pathways of glaciers running into the lake from the eastern summits also; but I failed to detect any very clear traces of such, either on the eastern or on the northern portion of the western side of the lake; while between the southwestern end and Sugar Pine Point, a distance of only eight or ten miles, I saw distinctly the pathways of five or six. North of Sugar Pine Point there are also several. *They are all marked by moraine ridges running down from the summits and projecting as points into the lake.* The pathways of three of these glaciers I studied somewhat carefully, and after a few preliminary remarks, will describe in some detail.

Mountains are the culminating points of the scenic grandeur and beauty of the earth. They are so, because they are also the culminating points of all geological agencies—igneous agencies in mountain *formation*, aqueous agencies in mountain *sculpture*. Now, I have already said that the mountain peaks which stand above the lake on every side, are highest at the southwestern end, where they rise to the altitude of 3,000 feet above the lake surface, or between 9,000 and 10,000 feet above the sea. Here, therefore, ran in the greatest glaciers, here we find the profoundest glacial sculpturings, and here also are clustered all the finest beauties of this the most beautiful of mountain lakes. I need only name Mt. Tallac, Fallen Leaf Lake, Cascade Lake, and Emerald Bay, all within three or four miles of each other and of the Tallac House. These three exquisite little lakes, (the Emerald Bay is also almost a lake) nestled closely against the loftiest peaks of the western summit ridge, are all perfect examples of glacial lakes.

South of Lake Tahoe, Lake Valley extends for fifteen miles as a plain, gently rising southward. At its lower end it is but a few feet above the lake surface, covered with glacial drift modified by water, and diversified, especially on its western side, by débris ridges, the moraines of glaciers which continued to flow into the valley or into the lake long after the main glacier, of which they were once tributaries, had dried up. On approaching the south end of the lake by steamer, I had observed these long ridges, divined their meaning, and determined on a closer acquaintance. While staying at the Tallac House I repeatedly visited them, and explored the cañons down which their materials were brought. I proceed to describe them.

Fallen Leaf Lake Glacier.—Fallen Leaf Lake (see map) lies on the plain of Lake Valley, about one a half miles from Lake Tahoe, its surface but a few feet above the level of the latter lake, but its bottom far, probably several hundred feet, below that level. It is about three to three and one-half miles long and one and one-fourth miles wide. From its upper end runs a cañon bordered on either side by the highest peaks in this region. The rocky walls of this cañon terminate on the east side at the head of the lake, but on the west side, a little further down. The lake is bordered on each side by an

admirably marked débris ridge (moraines) three hundred feet high, four miles long, and one and one-half to two miles apart. These moraines may be traced back to the termination of the rocky ridges which bound the cañon. On the one side the moraine lies wholly on the plain; on the other side its upper part lies against the slope of Mt. Tallac. Near the lower end of the lake a somewhat obscure branch ridge comes off from each main ridge, and curving around they form an imperfect terminal moraine, through which the outlet of the lake breaks its way.

On ascending the cañon the glaciation is very conspicuous, and becomes more and more splendid at every step. From Soda Springs (map s. s.) upwards, it is the most beautiful I have ever seen. In some places, for many acres in extent, the whole rocky bottom of the cañon is smooth and polished, and gently undulating, like the surface of a glassy but billowy sea. The glaciation is distinct, also, up the sides of the cañon 1,000 feet above its floor.

There can be no doubt, therefore, that a glacier once came down this cañon, filling it 1,000 feet deep, scooped out Fallen Leaf Lake just where it struck the plain and changed its angle of slope, and pushed its snout four miles out on the level plain, nearly to the present shores of Lake Tahoe, dropping its débris on either side, and thus forming a bed for itself. In its subsequent retreat it seems to have rested its snout some time at the lower end of Fallen Leaf Lake, and accumulated there an imperfect terminal moraine. The outlines of this little lake, with its bordering moraines, are shown in the diagram map.

2. *Cascade Lake Glacier.*—Cascade Lake, like Fallen Leaf Lake, is about one and one-half miles from Lake Tahoe, but, unlike Fallen Leaf Lake, its discharge creek has considerable fall, and the lake surface is, therefore, probably 100 feet above the level of the greater lake. On either side of this creek, from the very border of Lake Tahoe, runs a moraine ridge up to the lake, and thence close along each side of the lake up to the rocky points which terminate the true mountain cañon above the head of the lake. I have never anywhere seen more perfectly defined moraines. I climbed over the larger western moraine and found that it is partly merged into the eastern moraine of Emerald Bay to form a medial at least 300 feet high, and of great breadth, (see map.) From the surface of the little lake, the curving branches of the main moraine, meeting below the lake to form a terminal moraine, are very distinct. At the head of the lake there is a perpendicular cliff over which the river precipitates itself, forming a very pretty cascade of 100 feet or more. On ascending the cañon above the head of the lake, for several miles, I found, everywhere, over the lip of the precipice, over the whole floor of the cañon, and up the sides 1,000 feet or more, the most perfect glaciation.

There cannot be, therefore, the slightest doubt that this also is the pathway of a glacier which once ran into Lake Tahoe. After coming down its steep rocky bed, this glacier precipitated itself over the cliff, scooped out the lake at its foot, and then ran on until it bathed its snout in the waters of Lake Tahoe, and probably formed icebergs there. In its subsequent retreat it seems to have dropped more débris in its path, and formed a more perfect terminal moraine than did Fallen Leaf Lake Glacier.

Emerald Bay Glacier.—All that I have said of Fallen Leaf Lake and Cascade Lake, apply, almost word for word, to Emerald Bay. This beautiful bay, almost a lake, has also been formed by a glacier. It also is bounded on either side by moraines, which run down to and even project into Lake Tahoe, and may be traced up to the rocky points which form the mouth of the cañon at the head of the bay. Its eastern moraine, as already stated, is partly merged into the western moraine of Cascade Lake, to form a huge medial moraine. Its western moraine lies partly against a rocky ridge which runs down to Lake Tahoe to form Rubicon Point. At the head of the bay, as at the head of Cascade Lake, there is a cliff about 100 feet high, over which the river precipitates itself and forms a beautiful cascade. Over the lip of this cliff, and in the bed of the cañon above, and up the sides of the cliff-like walls, 1,000 feet or more, the most perfect glaciation is found. The only difference between this glacier and the two preceding is, that it ran more deeply into the main lake and the deposits dropped in its retreat did not rise high enough to cut off its little rock basin from that lake, but exists now only as a *shallow bar* at the mouth of the bay. This bar consists of *true moraine matter*, i. e., intermingled boulders and sand, which may be examined through the exquisitely transparent water almost as perfectly as if no water were present. Some of the boulders are of large size.

All that I have described separately and in detail, and much more, may be taken in at one view from the top of Mt. Tallac. From this peak nearly the whole course of these three glaciers, their fountain amphitheaters, their cañon beds, and their lakes enclosed between their moraine arms, may be seen at once. The view from this peak is certainly one of the finest I have ever seen. Less grand and diversified in mountain forms than many from peaks above the Yosemite, it has the added beauty of extensive water surface, and the added interest of several glacial pathways in a limited space. The observer sits on the very edge of the fountain amphitheaters still holding large masses of snow: immediately below, almost at his feet, lie glistening, gem-like, in dark, rocky setting, the three exquisite little lakes; on either side of these, embracing and protecting them, stretch out the moraine arms, reaching toward and directing the eye to the great lake, which lies, map-like, with all its sinuous outlines perfectly distinct, even to its extreme northern end, twenty-five to thirty miles away. As the eye sweeps again up the cañon-beds, little lakes, glacier-scooped rock basins, filled with ice-cold water, flash in the sunlight on every side. Twelve or fifteen of these may be seen.

From appropriate positions on the surface of Lake Tahoe, also, all the moraine ridges are beautifully seen at once, but the glacial lakes and the cañon-beds, of course, cannot be seen. I have attempted, in the rough sketch accompanying this paper, to express the combined results of observations from many points. The outlines of the great and small lakes are accurate, as these have been taken from reliable maps. Also the general position of the rocky points, and the moraine ridges, are tolerably correct. But, otherwise, the sketch is intended as an illustrative diagram rather than a topographical map. The view is supposed to be taken from an elevated position above the lake surface, looking southward.

There are several questions of a general nature suggested by my examination of these three glacial pathways, which I have thought best to consider separately.

a. Evidences of the existence of the Great Lake Valley Glacier.—In my former paper I have already given some evidence of the former existence of this glacier in the glacial forms detectable in the upper part of this valley. I will now give some additional evidence gathered last summer.

On the south shore of Lake Tahoe, and especially at the northern or lower end of Fallen Leaf Lake, I found many pebbles and some large boulders of a beautifully striped, agate-like slate. The stripes consisted of alternate bands, of black and translucent white, the latter weathering into milk white, or yellowish, or reddish. It was perfectly evident that these fragments were brought down from the cañon above Fallen Leaf Lake. On ascending this cañon I easily found the parent rock of these pebbles and boulders. It is a powerful outcropping ledge of beautifully striped silicious slate, full of fissures and joints, and easily broken into blocks of all sizes, crossing the cañon about a half mile above the lake. This rock is so peculiar and so easily identified that its fragments become an admirable index of the extent of the glacial transportation. I have, myself, traced these pebbles only a little way along the western shores of the great lake, as my observations were principally confined to this part; but I learn from my brother, Professor John Le Conte, and from Mr. John Muir, both of whom have examined the pebbles I brought home, that precisely similar fragments are found in great abundance all along the western shore from Sugar Pine Point northward, and especially on the extreme northwestern shore nearly thirty miles from their source. I have visited the eastern shore of the lake somewhat more extensively than the western, and nowhere did I see similar pebbles. Mr. Muir, who has walked around the lake, tells me that they do not occur on the eastern shore. We have, then, in the distribution of these pebbles, demonstrative evidence of the fact that Fallen Leaf Lake glacier was once a tributary of a much greater glacier which filled Lake Tahoe.

The only other agency to which we could attribute this transportation, is that of shore ice and icebergs, which probably did once exist on Lake Tahoe; but the limitation of the pebbles to the western, and especially the northwestern shores, is in exact accordance with the laws of glacial transportation, but contrary to those of floating ice transportation—for lake ice is carried only by winds, and would, therefore, deposit equally on all shores.

Again: I think I find additional evidence of a Lake Tahoe mer de glace in the contrasted character of the northern and southern shores of this lake.

All the little glacial lakes described above are deep at the upper end and shallow at the lower end. Further: all of them have a sand beach and a sand flat at the upper end, and great boulders thickly scattered in the shallow water, and along the shore at the lower end. These facts are easily explained, if we remember that while the glacial *scooping* was principally at the upper end, the glacial *droopings* were principally at the lower end. And further: that while the *glacial* deposit was principally at the lower end, the *river* deposit, since the glacial epoch, has been wholly at the upper end.

Now the great lake, also, has a similar structure. It also has a beautiful sand and gravel beach all along its upper shore, and a sand flat extending above it; while at its lower, or northern end, thickly strewed in the shallow water, and along the shore line, and some distance above the shore line, are found in great abundance *boulders of enormous size.* May we not conclude that similar effects have been produced by similar causes—that these huge boulders were dropped by the great glacier at its lower end? Similar boulders are also found along the northern portion of the eastern shore, because the principal flow of the ice-current was from the southwest, and in the fullness of glacial times the principal exit was over the northeastern lip of the basin.

b. Origin of Lake Tahoe.—That Lake Tahoe was once wholly occupied by ice, I think, is certain, but that it was scooped out by Lake Valley glacier is perhaps more doubtful. All other Sierra lakes which I have seen certainly owe their origin to glacial agency. Neither do I think we should be staggered by the size or enormous depth of this lake. Yet, from its position, it may be a plication-hollow, or a trough produced by the formation of two parallel mountain ridges, and afterwards modified by glacial agency, instead of a pure glacial-scooped rock-basin. In other words, Lake Valley, with its two summit ridges, *may well be regarded as a phenomena belonging to the order of mountain-formation and not to the order of mountain sculpture.* I believe an examination of the rocks of the two summit ridges would probably settle this. In the absence of more light than I now have, I will not hazard an opinion.

c. Passage of slate into granite.—From the commencement of the rocky cañon at the head of Fallen Leaf Lake, and up for about two miles, the cañon walls and bed are composed of *slate.* The slate, however, becomes more and more metamorphic as we go up, until it passes into what might be called *trap.* In some places it looks like *diorite,* and in others like *porphyry.* I saw no evidence, however, of any outburst. This latter rock passes somewhat more rapidly into *granite* at Soda Springs. From this point the cañon bed and lower walls are granite, but the highest peaks are still a dark, splintery, metamorphic slate. The glacial erosion has here cut through the slate and bitten deep into the underlying granite. The passage from slate through porphyritic diorite into granite, may, I think, be best explained by increasing degree of metamorphism, and at the same time a change of the original sediments at this point, granite being the last term of metamorphism of pure clays, or clayey sandstones, while bedded diorites are similarly formed from ferruginous and calcareous slates. Just at the junction of the harder and tougher granite with the softer and more jointed slates, occur, as might be expected, cascades in the river. It is probable that the cascades at the head of Cascade Lake and Emerald Bay mark, also, the junction of the granite with the slate—only the junction here is covered with débris. Just at the same junction, in Fallen Leaf Lake Cañon, burst out the waters of Soda Springs, highly charged with bicarbonates of iron and soda.

d. Glacial Deltas.—I have stated that the moraines of Cascade Lake and Emerald Bay glaciers run down to the margin of Lake Tahoe. An examination of this portion of the lake shore shows that *they ran far into the lake*—

that the lake has filled in two or three miles by glacial débris. On the east margin of Lake Tahoe, the water, close along the shore, is comparatively shallow, the shore rocky, and along the shore-line, above and below water, are scattered great boulders, probably dropped by the main glacier. But on the west margin of the lake the shore-line is composed wholly of moraine matter, the water very deep close to shore, and the bottom composed of precisely similar moraine matter. In rowing along the shore, I found that the exquisite ultramarine blue of the deep water extends to within 100–150 feet of the shore-line. At this distance, the bottom could barely be seen. Judging from the experiments of my brother, Professor John Le Conte, according to which a white object could be seen at a depth of 115 feet, I suppose the depth along the line of junction of the ultramarine blue and the emerald green water, is at least 100 feet. The slope of the bottom is, therefore, nearly, or quite, 45°. It seems, in fact, a direct continuation beneath the water of the moraine slope. The materials, also, which may be examined with ease through the wonderfully transparent water, are exactly the same as that composing the moraine, viz: earth, pebbles, and boulders of all sizes, some of them of enormous dimensions. It seems almost certain that *the margin of the great Lake Valley glacier, and of the lake itself when this glacier had melted and the tributaries first began to run into the lake, was the series of rocky points at the head of the three little lakes, about three or four miles back from the present margin of the main lake; and that all lakeward from these points has been filled in and made land by the action of the three glaciers described.* At that time Rubicon Point was a rocky promontory, projecting far into the lake, beyond which was another wide bay, which has been similarly filled in by débris brought down by glaciers north of this point. The long moraines of these glaciers are plainly visible from the lake surface; but I have not examined them. Thus, all the land, for three or four miles back from the lake-margin, both north and south of Rubicon Point, is composed of *confluent glacial deltas*, and on these deltas the moraine ridges are the *natural levées* of these ice-streams

e. Parallel Moraines.—The moraines described above are peculiar and almost unique. Nowhere, except about Lake Tahoe and near Lake Mono, have I seen moraines in the form of *parallel ridges*, lying on a level plain and terminating abruptly *without any signs of transverse connection* (*terminal moraine*) *at the lower end.* Nor have I been able to find any description of similar moraines in other countries. They are not terminal moraines, for the glacial pathway is open below. They are not lateral moraines, for these are borne on the glacier itself, or else stranded on the steep cañon sides. Neither do I think moraines of this kind would be formed by a glacier emerging from a steep narrow cañon and running out on a level plain; for in such cases, as soon as the confinement of the bounding walls is removed, the ice stream spreads out into an *ice lake*. It does so as naturally and necessarily as does water under similar circumstances. The deposit would be nearly transverse to the direction of motion, and, therefore, more or less crescentic. There must be something peculiar in the conditions under which these parallel ridges were formed. I believe the conditions were as described below.

We have already given reason to think that the original margin of the lake in glacial times was three or four miles back from the present margin, along the series of rocky points against which the ridges abut; and that all the flat plain thence to the present margin is made land. If so, then it is evident that at that time the three glaciers described ran far out into the lake, until reaching deep water, they formed icebergs. Under these conditions, it is plain that the pressure on this, the subaqueous portion of the glacial bed, would be small, and become less and less until it becomes nothing at the point where the icebergs float away. The pressure on the bed being small, not enough to overcome the cohesion of the ice, there would be no spreading. *A glacier running down a steep narrow cañon and out into deep water, and forming icebergs at its point, would maintain its slender, tongue-like form, and drop its débris on each side, forming parallel ridges, and would not form a terminal moraine, because the materials not dropped previously would be carried off by icebergs.* In the subsequent retreat of such a glacier, imperfect terminal moraines might be formed higher up, where the water is not deep enough to form icebergs. It is probable, too, that since the melting of the great mer de glace and the formation of the lake, the level of the water has gone down considerably, by the deepening of the Truckee Cañon outlet by means of erosion. Thus, not only did the glaciers retreat from the lake, but also the lake from the glaciers.

As already stated, similar parallel moraine ridges are formed by the glaciers which ran down the steep eastern slope of the Sierras, and out on the level plains of Mono. By far the most remarkable are those formed by Bloody Cañon Glacier, and described in my former paper. These moraines are six or seven miles long, 300–400 feet high, and the parallel crests not more than a mile asunder. There, also, as at Lake Tahoe, we find them terminating abruptly in the plain without any sign of terminal moraine. But higher up there are small, imperfect, transverse moraines, made during the subsequent retreat, behind which water has collected, forming lakes and marshes. But observe: these moraines are also *in the vicinity of a great lake;* and we have abundant evidence, in very distinct terraces described by Whitney,* and observed by myself, that in glacial times the *water stood at least six hundred feet above the present level.* In fact, there can be no doubt that at that time the waters of Mono Lake (or a much greater body of water of which Mono is the remnant) washed against the bold rocky points from which the débris ridges start. *The glaciers in this vicinity, therefore, must have* run out into the water six or seven miles, and doubtless formed icebergs at their point, and, therefore, formed no terminal moraine there.

That the glaciers described about Lake Tahoe and Lake Mono ran out far into water and formed icebergs, I think is quite certain, and that parallel moraines opened below are characteristic signs of such conditions, I also think nearly certain.

f. Glacial Erosion.—My observation on glacial pathways in the high Sierra, and especially about Lake Tahoe, have greatly modified my views as to the

* Geological Survey of California, Vol. I, p. 451.

nature of glacial erosion. All writers on this subject seem to regard glacial erosion as mostly, if not wholly, a *grinding* and *scoring;* the débris of this erosion as rock-meal; the great boulders which are found in such immense quantities in the terminal deposit, as derived wholly from the crumbling cliffs above the glacial surface; the *rounded* boulders, which are often the most numerous, as derived in precisely the same way, only they have been engulfed by crevasses, or between the sides of the glacier and the bounding wall, and thus carried between the moving ice and its rocky bed, as between the upper and nether millstone. In a word, all boulders, whether angular, or rounded, are supposed to owe their *origin* or *separation* from their parent rock to atmospheric agency, and only their *transportation* and *shaping* to glacial agency.

Now, if such be the true view of glacial erosion, evidently its effect in mountain sculpture must be small indeed. Roches moutonneés are recognized by all as the most universal and characteristic sign of a glacial bed. Sometimes these beds are only imperfectly moutonneés, i. e., they are composed of *broken angular surface with only the points and edges planed off.* Now, moutonneés surfaces always, and especially angular surfaces with only points and edges beveled, show that the erosion by grinding has been only very superficial. They show that if the usual view of glacial erosion be correct, the great cañons, so far from being *formed*, were only very *slightly modified* by glacial agency. But I am quite satisfied from my own observations that this is not the only *nor the principal* mode of glacial erosion. I am convinced that a glacier, by its enormous pressure and resistless onward movement, is *constantly breaking off large blocks* from its bed and bounding walls. Its erosion is not only a grinding and scoring, but also a *crushing and breaking.* It makes by its erosion not only rock-meal, but also large *rock-chips.* Thus, a glacier is constantly breaking off blocks and making angular surfaces, and then grinding off the angles both of the fragments and the bed, and thus forming rounded boulders and moutonneés surfaces. Its erosion is a constant process of alternate *rough hewing* and *planing.* If the rock be full of fissures, and the glacier deep and heavy, the rough hewing so predominates that the plane has only time to touch the corners a little before the rock is again broken and new angles formed. This is the case high up on the *cañon walls*, at the head of Cascade Lake and Emerald Bay, but also in the *cañon beds wherever the slate is approached.* If, on the other hand, the rock is very hard and solid, and the glacier be not very deep and heavy, the planing will predominate over the rough hewing, and a smooth, gently billowy surface is the result. This is the case in the hard granite forming the beds of all the cañons high up, but especially high up the cañon of Fallen Leaf Lake, where the cañon spreads out, and extensive but comparatively thin snow-sheets have been at work. In some cases *on the cliffs*, subsequent disintegration of a glacier-polished surface may have given the appearance of angular surfaces with beveled corners; but, in other cases, in the *bed of the cañon*, and on elevated level places, where large loosened blocks could not be removed by water nor by gravity, I observed the same appearances, under conditions which forbid this explanation. Mr. Muir, also, in his Studies in the Sierra, gives many examples of undoubted rock-breaking by ancient glaciers.

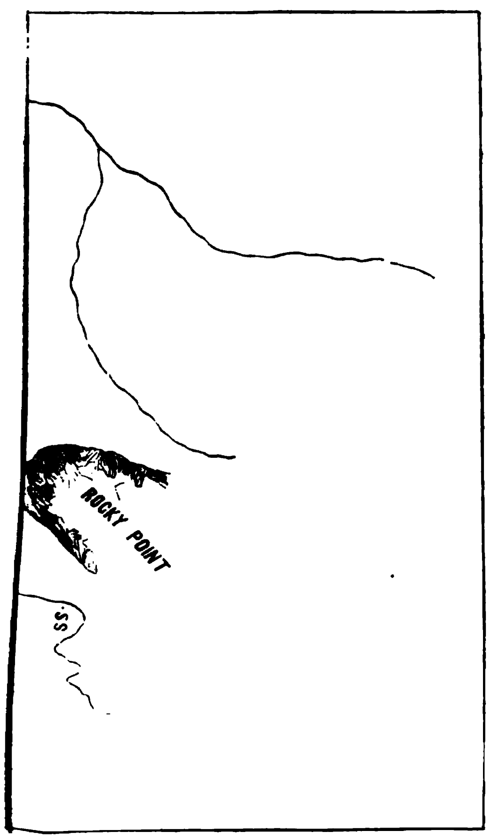
Angular blocks are, therefore, mostly the ruins of crumbling cliffs, borne on the surface of the glacier and deposited at its foot. Many *rounded* boulders also have a similar origin, having found their way to the bed of the glacier through crevasses, or along the sides of the glacier. But *most of the rounded boulders* in the terminal deposit of *great glaciers* are fragments *torn off by the glacier itself*. The proportion of angular to rounded boulders—of upper or air-formed to nether or glacier-formed fragments, depends on the depth and extent of the ice current In the case of the universal ice-sheet (ice-flood) there is, of course, no upper formed or angular blocks at all—there is nothing borne on the surface. The moraine, therefore, consists wholly of nether-formed and nether-borne severely triturated materials (*moraine profonde*). The boulders are, of course, all rounded. This is one extreme. In the case of the thin moving ice-fields—the *glacierets* still lingering amongst the highest peaks and shadiest hollows of the Sierra—on the other hand, the moraines are composed *wholly of angular blocks*. This is the character of the terminal moraine of Mt. Lyell glacier, described in my previous paper. These glacierets are too thin and feeble and torpid to break off fragments—they can only *bear* away what falls on them. This is the other extreme. But in the case of ordinary glaciers—*ice streams*—the boulders of the terminal deposit are mixed; the angular or upper-formed predominating in the small existing glaciers of temperate climates, but the rounded, or nether-formed, greatly predominating in the grand old glaciers of which we have been speaking. In the terminal deposits of these, especially in the materials pushed into the lake, it is somewhat difficult to find a boulder which has not been subjected to severe attrition.

Professor John LeConte described two new pieces of apparatus lately added to that of the University, one for projecting microscopic objects, and the other for measuring the force of electric currents.

Dr. Kellogg read a paper on Hops.

Resolutions expressive of interest in the affairs of the University, and satisfaction at the advancment made, were adopted.

President Gilman then addressed the members, after which the Academy adjourned to examine the buildings and grounds.


ROCKY POINT
SS.

Regular Meeting, March 1st, 1875.

Robert E. C. Stearns in the Chair.

Eighteen members present.

The following names were submitted as candidates for membership: Alfred E. Regensberger, Jas. B. Clifford and Charles Frances.

Donations to the Museum: From Professor Davidson, specimen of Mandarin Duck from Nagasaki, Japan. From Mrs. John Torrence, specimens of *Ostrea titan* from San Luis Obispo Co. From Captain S. P. Griffin of the Steamship "City of Peking," specimens of eyeless eels (genus *Petromyzen* or *Bellostoma?*), caught coiled around fishing line in seven fathoms of water, mud bottom, in Fortesque Bay, Straits of Magellan, November 25, 1874; also intestinal worms found in the porpoise. Jas. Dean presented three Indian pestles made of stone, and nine bone bodkins or pins, from a large mound, covering two acres, and twenty-five feet deep, at Visitacion Valley, near San Bruno road; also specimens of coals from Queen Charlotte's Island; also coal from Vancouver's Island, and specimen of bog iron. E. O. McDevitt donated a large and choice assortment of New Zealand minerals.. From Mrs. J. J Greene, fossil, *Tamiosona gigantea*, from Wild Horse Cañon, eight miles from Lowe's station.

The Secretary read a paper by S. B. Christy, as follows:

Notes on a Meteor seen at Berkeley.

BY S. B. CHRISTY.

On the evening of December 9, 1874, as I was sitting in my room, I happened to have my attention called to something without, and while looking from my window saw, what at first appeared to be the moon in her first quarter, of about the *same size*, *color* and *brilliancy*, shining through a dim fog, which latter was heavy enough to obscure all the lesser stars. As, however,

it flashed over me in a second that the moon was not out at that time and place, and as above all it was moving steadily downwards, and to the left, I watched it with attention and noticed that it seemed to grow a little larger and brighter, until finally, like a piece of burning paper, it seemed to flare up suddenly with a *reddish* light, and go out in silence.

The next day but one, as Professor John LeConte had asked me to record its appearance, as near as may be, I repaired to the same place at about the same time as before, so as to have the conditions as near the same as before, and with a transit took the bearings of its course as nearly as could be done by such a rude means of approximation.

Bearing at commencement	S. 83° E.
Bearing at end	S. 81° E.
Altitude at commencement	35°
Altitude at end	25°

The duration, as near as I could judge, was one second. The date, December 9, 1874; 6:30 P. M.

Charles Wolcott Brooks read the following:

Report of Japanese Vessels wrecked in the North Pacific Ocean, from the Earliest Records to the Present Time.

BY CHARLES WOLCOTT BROOKS.

Every junk found adrift or stranded on the coast of North America, or on the Hawaiian or adjacent islands, has on examination proved to be Japanese, and no single instance of any Chinese vessel has ever been reported, nor is any believed to have existed.

This may be explained by the existence of the Kuro Shiwo, literally "black stream," a gulf stream of warm water, which sweeps northeasterly past Japan toward the Kurile and Aleutian Islands, thence curving around and passing south along the coast of Alaska, Oregon and California. This stream, it is found, has swept these junks toward America at an average rate of fully ten miles a day.

There also exists an ocean stream of cold water, emerging from the Arctic Ocean, which sets south close in along the eastern coast of Asia. This fully accounts for the absence of Chinese junks on the Pacific, as vessels disabled off their coast would naturally drift southward.

A noticeable feature is the large number of disasters on the coast of Japan in the month of January, during which season the strong northeast monsoons blow the wrecks directly off shore into the Kuro Shiwo.

The climate of Japan is temperate, with the exception of the extreme northern provinces, where intense cold prevails and where snow is abundant; and the extreme southern provinces, whose climate is very warm.

About the year 1639 the Japanese Government ordered all junks to be built with open sterns, and large square rudders, unfit for ocean navigation, hoping

+ JAPANESE WRECKS.

DRAWN BY CHARLES WOLCOTT BROOKS.

thereby to keep their people isolated within their own islands. Once forced from the coast by stress of weather, these rudders are soon washed away, when the vessels naturally fall off into the trough of the sea, and roll their masts out. The number, of which no record exists, which have thus suffered during the past nineteen centuries must be very large, probably many thousand vessels.

Among Japanese mariners, the fear of being thus blown off their coast, has been an ever-threatening danger; and the memory of such time-honored accidents, is a common feature in the traditions of every seaport settlement along the eastern coast of Japan.

By the Government Census, taken in 1874, the total population of Japan was 33,300,675 souls, and there were 22,670 registered sailing vessels of Japanese style, (junks) of from 8 to 383 tons, engaged in the coasting trade. The crews of ordinary trading junks average from eight to twelve men each.

In the sixteenth year of the reign of the Emperor Suizin, B. C. 81, merchant ships and ships of war are first spoken of as built in Japan.

Under the Shogoon Iyémitsu, about 1639, edicts commanded the destruction of all boats built upon any foreign model, and forbade the building of vessels of any size or shape superior to that of the present junk.

By the imperial decree of 1637, Japanese who had left their country and been abroad, were not allowed to return, death being the penalty for traveling abroad, studying foreign languages, introducing foreign customs, or believing in Christianity.

The Empire of Japan is situated in the northwestern part of the Pacific Ocean, and is composed of four large islands and of a great number of smaller ones. It faces to the northwest the Kingdom of Corea, and is separated from it by the Japan sea. To the northeast the archipelago of Chijima (Kurile Islands) extends towards Kamschatka. At the southwest the Liu Kiu Islands are situated opposite the Island of Formosa.

Its whole length, extending from one end to the other of the empire, measures more than 500 Ris (about 1225 English miles), and its breadth varies from 20 to 60 Ris (about 73½ to 146 English miles.) Its total area is 23,740 Square Ris.

The sources of information at command have been exceptionally good. During seventeen years, in which I represented the Government of Japan at this port, it has been my pleasure to devote much critical attention to the subject of Japanese wrecks, picked up adrift in the North Pacific Ocean and stranded upon the northwest coast of America and its various outlying islands, and those of the chain extending from Hawaii towards Niphon. Besides keeping a detailed record of all wrecks reported during this period, I have also collected and verified many cases of earlier reports, which although still extant, were likely to be overlooked.

In at least 37 of the cases quoted, I have either seen the saved, or received a personal account from those who were themselves witnesses. Hawaiian and Japanese traditions I have myself gathered in those countries.

In March, 1860, I took an Indian boy on board the Japanese steam corvette *Kanrin-maru*, where a comparison of Coast-Indian and pure Japanese words was made at my request, by Fukuzawa Ukitchy, then Admiral's Secretary;

the result of which I prepared for the press, and it was at that time published in the *Evening Bulletin*, suggesting further linguistic investigation.

The following examples submitted for consideration to the Academy, fairly illustrate the subject in its various phases:—

1. In Mr. Hubert H. Bancroft's unparalleled collection of ancient books and valuable manuscripts relating to the early history of the native races of the Pacific States, mention is made of several Japanese vessels reported in some of the Spanish-American ports on the Pacific. In 1617 a Japanese junk belonging to Magomé, was at Acapulco.

In 1613, June 10th, the British ship *Clove*, Capt. John Saris, arrived at Nagasaki, having on board one Japanese, picked up from the island of Bantam.

2. "In 1685," we read, "the Portuguese tried for the last time to re-establish their trade by sending back a number of shipwrecked Japanese, picked up adrift, to their own country. The Japanese did not molest them, but strictly prohibited their re-appearance on the Coast of Japan."

3. In 1694, a Japanese junk from Osaka was driven by adverse winds and weather and stranded on the coast of Kamschatka, at the mouth of the river Opala, on the south of Bolschaia Reka. The only survivor was afterwards taken to Moscow.

Muller, in his "Voyages from Asia to America," published in 1761, remarks that when in 1696 the Russians reported the above, they said: "we have learned of several other instances of Japanese wrecks previously stranded on the coast of Kamschatka."

4. In 1710, a Japanese junk was stranded on the coast of Kamschatka, in Kaligirian bay, north of Awatscha. Ten persons landed safely, of which four were killed and six taken captive in an encounter with Kamschadels. Subsequently four of the captives fell into Russian hands, and one named Sanima, was sent in 1714 to St. Petersburg.

5. On the 8th of July, 1729, a Japanese junk called the *Waka-shima* of Satsuma, in distress, after having been driven about at sea for six months, was finally stranded on the coast of Kamschatka, south of Awatscha bay, and 17 of her crew were saved. She was loaded with cotton and silk stuffs, rice and paper; the two latter articles shipped by *Matsudaira Osumi-no-kami*, (Prince of Satsuma) were government property.

A petty Russian officer named Schtinnikow, desiring to plunder the cargo, had fifteen of the survivors shot; for which crime he was subsequently condemned and hung. The two remaining, an old merchant named Sosa and a young pilot Gonsa, were sent to Irkutz in 1721, and thence via Tobolsk, they reached St. Petersburg in 1732, where one died in 1736, the other in 1739.

6. In 1782 a Japanese junk was wrecked upon the Aleutian Islands, from which the survivors were taken in one of the Russian-American Company's vessels to the town of Ochotsk, and thence to the inland city of Irkutsk. In 1792, the Governor-General of Siberia ordered the transport *Catherine*, then at Ochotsk, to return these men to their native country. The Russian vessel, after wintering in a harbor at the north end of Yeso, proceeded to the port of Hakodaté, where the Japanese officials politely but

firmly refused to allow their countrymen to land. They were subsequently returned to Siberia.

7. Among items of history mentioned in Japanese records, I find that in October, 1804, a Russian frigate commanded by Capt. Krusenstern, conveying Count Resanoff, as Ambassador of the Czar, brought back to Nagasaki five Japanese seamen, being part of a crew of fifteen rescued from a stranded junk; the other ten preferred to remain in Siberia.

8. In 1805, a Japanese junk was wrecked on the coast of Alaska, near Sitka; the seamen were quartered on Japonski Island, whence they were taken by the Russians, and finally landed on the Coast of Yeso in 1806.

9. In 1812, Capt. Ricord, commanding the Russian sloop-of-war *Diana*, took seven Japanese, six of whom were seamen recently shipwrecked in a junk on the coast of Kamschatka, in the hope of exchanging them for seven captive Russians, confined in Japan. Being unable to land, they were returned to Kamschatka, reaching there October 12th. The *Diana* made a second attempt, and finally succeeded August 16th, 1813, in landing these Japanese at Kunashie Bay, the 20th Kurile, and effected the liberty of the Russian Capt. Golownin and his associates.

10. In 1813, the Brig *Forrester*, Captain John Jennings, when in latitude 49° N., longitude 128° W., rescued the captain and two seaman from a dismasted junk, timber laden, when 18 months from Yeso, bound to Niphon. Thirty-five men were on board, of whom thirty-two died of hunger. They were delivered to the Russians, who undertook to return them to Japan.

11. Captain Alexander Adams, formerly pilot at Honolulu, relates that March 24, 1815, in latitude 32° 45′ N., longitude 126° 57′ W., when sailing master of brig *Forrester*, Captain Piggott, and cruising off Santa Barbara, California, he sighted at sunrise a Japanese junk drifting at the mercy of the winds and waves. Her rudder and masts were gone. Although blowing a gale, he boarded the junk, and found fourteen dead bodies in the hold, the captain, carpenter, and one seaman alone surviving; took them on board, where by careful nursing they were well in a few days. They were on a voyage from Osaka to Yedo, and were 17 months out, having been dismasted in consequence of losing their rudder.

12. In 1820, a junk was cast upon Point Adams, the southern shore of the mouth of Columbia river. The vessel, which was laden with wax, went to pieces, and the crew, many in number, landed safely.

13. A junk was wrecked on Queen Charlotte's Island, in 1831.

14. December 23, 1832, at mid-day, a junk in distress cast anchor near the harbor of Waialua, on the shores of Oahu. She was from a southern port of Japan, bound to Yedo with a cargo of fish; lost her rudder and was dismasted in a gale, since which she had drifted for eleven months. Five out of her crew of nine had died. December 30th, she started for Honolulu, but was stranded on a reef off Barber's Point on the evening of January 1, 1833. The four survivors were taken to Honolulu, where, after remaining eighteen months, they were forwarded to Kamschatka, whence they hoped to work their way south through the northern islands of the group into their own country. This junk was about 80 tons burden. According to the tra-

ditions of the islands, several such junks had been wrecked upon Hawaii, before the islands were discovered by Captain Cook.

15, 16. In 1833, a Japanese junk was wrecked on the coast of Washington Territory, in the immediate vicinity of Cape Flattery. Many of her crew had perished, and several dead bodies were found headed up in firkins, in customary Japanese style, ready for burial. Out of 17 persons, the only survivors, two men and a boy, were rescued from the Indians, by the Hudson Bay Company's vessel *Lama*, Captain McNeal, who took them to England, touching at Honolulu on their way. Thence they proceeded to Canton, where they arrived in 1836, and stopped with Karl Gutzlaff, who learned their language, and intended accompanying them to Japan. In 1837, they left Macao in the American brig *Morrison*, dispatched by Clarence A. King for Yedo bay, to bear them home. Being fired upon, July 27, and prevented from landing, she sailed for Kagosima, where, being equally unsuccessful, she finally returned with the men to Macao. The *Morrison*, on whom Samuel W. Williams and Dr. Peter Parker were passengers, also had on board four other Japanese seamen, rescued from a disabled Japanese junk, which had drifted a long time at sea, until finally stranded on the eastern shore of the Philippine Islands, whence the survivors were forwarded to Macao, to be returned to Japan.

17. In 1839, a wrecked junk was boarded by Captain Cathcart of the American whale ship *James Loper*, drifting in latitude 30° N., longitude 174° W., or about half way between Japan and the Hawaiian Islands.

18. In the *Polynesian*, October 17, 1840, published at Honolulu, I find: "The Japanese who took passage in the *Harlequin* remained at Kamschatka under the protection of the Governor awaiting an opportunity of returning to their native country."

NOTE.—In 1834, the brig *Harlequin* conveyed to Petropaulski from Honolulu 18 Japanese taken from wrecks, who had remained 18 months at Honolulu. They were finally returned to Japan by Russian officials.

In 1840, Mr. Nathaniel Savory, a native of Massachusetts, residing at Port Lloyd, Bonin Islands, reports a Japanese junk of about 40 tons, laden with dried fish, entered that harbor in distress, having been driven from her course along the coast of Japan through stress of weather, with her provisions exhausted. They repaired the damage to the junk during that winter, and she sailed in the spring for Japan. Had these islands been uninhabited, this case would have added another to the list of wrecks.

19. In 1841, a fishing junk from the southeast part of Niphon was wrecked on an uninhabited island, where the three survivors remained six months, until taken off by Captain Whitfield, master of the American whale ship *John Howland*, and brought to Honolulu, where Denzo and Goémon remained, while Nakahama Manjiro went to the United States, and was educated by Captain Whitfield. After being there several years he returned to Honolulu where he found his former companions, and embarked January, 1851, on the *Sarah Boyd*, Captain Whitmore, bound for Shanghai, taking with them a whale-boat called the *Adventure*, with a full rig and outfit. When off the Grand Liu-Kiu, the three Japanese effected a landing and the ship proceeded without stopping. Hence they finally reached Kiushiu and Nagasaki, in the

junk which bears the annual tribute money from Liu-Kiu to Japan. Manjiro afterwards translated Bowditch's Navigator into Japanese, and visited San Francisco as sailing-master of the Japanese steam corvette *Kanrin-maru*, which arrived there March 17th, 1860.

20. In 1845, the United States Frigate *St. Louis* took from Mexico to Ningpo, in China, three shipwreck Japanese, being survivors of the crew of a junk which had drifted from the coast of Japan, entirely across the Pacific Ocean, and finally stranded on the coast of Mexico, where they remained two years. The Chinese authorities were willing to receive these men and return them to their native country by their annual junk, which sails from Cheefoo to Nagasaki; but the Japanese objected to their landing, owing to the law of 1637.

In 1845, the Japanese authorities informed Sir Edward Belcher, commanding H.B.S. *Samarang*, that they would not receive returned Japanese from abroad, but "had sent a junk-full back to the Emperor of China," to whose country they had gone to obtain return passages by the annual junk permitted from Cheefoo to Nagasaki. The above leads to the inference that the *Samarang* may have had shipwrecked Japanese seamen on board.

21. In 1845, April 1st, Captain Mercator Cooper, of Sag Harbor, when in the American whale ship *Manhattan*, rescued eleven shipwrecked Japanese mariners from St. Peters, a small island lying a few degrees southeast of Niphon, and took them to Yedo Bay, where they were received under exception. Captain Cooper is also reported to have fallen in with a sinking junk, from which he rescued as many more Japanese seamen. [See Dr. C. F. Winslow's account in *Friend* of February 2d, 1846.]

22. In 1847, a French whaleship while cruising off Stapleton Island, sighted a fire-signal on the shore, and sent a boat to the relief of five Japanese sailors, who were in a helpless plight; the only survivors of a crew, whose disabled junk lay stranded on the beach of a small bay. Later, about 1853, a party of officers from the U. S. steam frigate *Susquehanna* landed and surveyed this wreck, which they then described as "still partly kept together by large nails of copper, and portions of sheets of metal. Her planks, fastened together at the edge, were but little rubbed or decayed."

23. In 1847, April 21st, the Bremen ship *Otaheite*, Captain Weitung, when in lat. 35° N., long. 156° E., fell in with a Japanese junk in distress, which had lost her rudder and had been driven off the coast of Japan in a gale November, 1846, and had drifted five months. Took off the crew, consisting of nine men, also six tons of wax. She was about 80 tons burden and chiefly laden with paper belonging to Osaka, and bound north. Captain Weitung kept them on board four weeks, and May 19th, 1847, put them on board a junk in the Straits of Matsmai. [See *Polynesian*, October 17, 1847, and *Friend*, December 2, 1847.]

24. In 1848, Captain Cox of New London, Conn., picked up fifteen of twenty Japanese seamen from a disabled junk in lat. 40° N., long. 170° W., and kept them on board six months during a cruise in the Ochotsk sea, and finally landed them at Lahaina, where they remained six or eight months.

25. In 1850, during the autumn, S. Senthari, Toro and J. Heco—the latter then aged 13 years—left Osaka in a junk for Yedo. After discharging and reloading they started to return via Woragawa. After leaving the latter

place their rudder was disabled and they lost their mast and drifted out to sea. Fifty days later the wreck was fallen in with by the American bark *Auckland*, Captain Jennings, who took off and brought the crew of 17 persons to San Francisco, in February, 1851. They were quartered on board the U. S. revenue cutter, and cared for by order of the Collector of the Port. Our citizens generally took much interest in them. The Japanese were subsequently embarked on the U. S. sloop *St. Mary's* and conveyed to Hongkong, where 15 were transferred to the U. S. steamer *Susquehanna* to await the arrival of Commodore Perry and his expedition. Heco and the second mate, Toro, returned to San Francisco on the bark *Sarah Hooper*, reaching there in the autumn of 1852. Senthuro returned with Rev. Mr. Goble, from San Francisco to Japan, and also Toro returned in the American bark *Melita* to Hakodaté from San Francisco, via Honolulu, April 19, 1859.

Toro was for a while clerk with Wells, Fargo & Co., and Joseph Heco, clerk with Macondray & Co. Heco was subsequently appointed for duty on the United States Surveying Schooner *Fennimore Cooper*, about 1858-59, and left her at Honolulu, on account of sickness, but finally returned to Yedo, on the United States steamer *Mississippi*. [See *Evening Bulletin*, June, 1862.]

26. In 1850, April 22d, in lat. 45° N. long. 155° E., the American whale ship *Henry Kneeland*, Clark, master, fell in with a Japanese junk having 13 persons on board. The vessel left Yedo for Kuno, but lost her rudder and was dismasted; then drifted to sea, and had been at the mercy of the winds and currents for sixty-six days, during forty of which they had subsisted on fish and snow water. The Captain and two seamen came to Honolulu on the *H. K.*; two of the crew were transferred to the *Marengo*; six were taken to Petropaulski and taken charge of by the Russian authorities, and two came to Honolulu by the *Nimrod*. [See *Friend*, October 15, 1850; also *Friend*, November 1, 1850.]

NOTE.—In 1851, by Japanese records I find that five Japanese seamen from Honolulu via China arrived at Nagasaki—probably the above.

27. In 1851, a Japanese junk was cast away upon Atka Island, and only three of the crew survived.

28. In 1852, April 15th, in lat. 31° N., long. 150° E., about 300 miles N. N. E. of Guam, Captain West, in the American whaleship *Isaac Howland*, fell in with a small Japanese junk in ballast. The four men on board had but a little oil to sustain life, and were much emaciated. Their tiller was lashed, and the vessel having been forty-nine days out of their reckoning, the crew had given themselves up to die. Two of these men Captain West took to the Atlantic States, and two were transferred to an American whaler about to cruise in the vicinity of the Japanese Islands.

29. In March, 1853, the American ship *John Gilpin*, Captain Doane, passed a water-logged wreck of a junk, her deck awash with the water, in lat. 18° —' N., long. 145° —' E., just beyond Pagan and Grigan Islands. Large numbers of fish were around the wreck. There were no survivors on board. She had every appearance of having been a very long time in the water.

30. In 1853, Captain C. M. Scammon discovered the wreck of a Japanese junk, on the southwest or largest of the San Bonito group of Islands, off

Lower California, in lat. 28° N., long. 116° W., and near Cedros Island. [See *Alta*, April 22, 1860.]

Her planks were fastened together on the edges with spikes or bolts of a flat shape, with all of the head on one side. The seams were not quite straight, although the workmanship otherwise was good. That portion of the wreck in sight, was principally the bottom of the vessel, and gave evidence of having been a long time on shore. [Extract from Captain Scammon's log.]

31. In 1854, August 14th, just after Commodore Perry's departure, the American ship *Lady Pierce*, Captain Burrows, arrived at Simoda from San Francisco via Honolulu June 2, 1854. She returned Diyonoské to Japan, who was the sole survivor of a crew of fifteen men, and was picked off from a drifting junk near the Hawaiian Islands, after being seven months helpless at sea. He had resided some time in San Francisco.

32. In 1855, Captain Brooks, in American brig *Leverett*, which arrived here from Ayan, Siberia, November 29th, picked up an abandoned junk in lat. 42° N., long. 170° W., about 900 miles from the American Coast.

33. In 1856, the American bark *Messenger Bird*, Captain Homer, reported a disabled junk at Guam, Ladrone Islands.

34. In 1856, Captain Jno. C. Lawton, in the brig *Prince de Joinville*, while getting guano at Cedros and adjacent islands, reported a Japanese wreck, seen near Magdalena Bay.

35. In 1858, the U.S. surveying schooner *Fennimore Cooper*, Lieut. John M. Brooke, U.S.N. commanding, sailed from Honolulu for a cruise along the chain of islands extending thence towards Japan. He had on board a Japanese seaman named Marsa-Kitchi, whom he landed at Kanagawa. The junk from which this man was taken, was disabled at sea while engaged in the coasting trade, and her crew were forced to put her before the wind, heading to the eastward, a direction in which they were forced against their will. To prevent drifting too rapidly, they lowered their anchor in the open sea to act as a drag, paying out their full length of cable, and thus allowed it to remain until it finally parted.

36. In 1858, May 19th, the British ship *Caribean*, when in lat. 43° 40′ N., long. 171° E., about 1,600 miles from the coast of Japan, fell in with a dismasted junk, which had carried away her rudder, and had been about five months floating helplessly at sea. The captain, mate and ten seamen were rescued and brought to San Francisco, where they arrived June 7, 1858. They were cared for by Captain Winchester, who took them in the *Caribean* to Vancouver Island, whence he was bound for China, but having met a British war vessel off Japan, the rescued men were transferred to her, and thus landed at a Japanese port.

The junk was loaded with barley and rice, and barnacles two feet long were reported found upon the wreck.

The British Government presented £400 to Captain Winchester as a reward and in reimbursement of his necessary outlays.

37. In 1859, the bark *Gambia*, Captain Brooks, found the remains of a Japanese junk on Ocean Island, lat. 28° 24′ N., long. 178° 21′ W.

38, 39. In 1859, July 4th, the remains of two stranded junks, with lower

masts high on the beach, were found on the east or lagoon side of Brooks Island, lat. 28° 11′ N. long. 177° 18′ to 25′ W.

40. May 11th, 1862, the bark *Yankee*, Captain Claxton, passed in lat. 25° 39′ N., long. 138° 24′ W., a wreck with the stump of one mast only standing, of which the wood was quite black with age. The junk was water-logged, and the sea washing entirely over her. Being satisfied there was no life upon her, and a heavy sea running, did not board; passed her three-quarters of a mile to windward, and the *Yankee* kept on her course.

41. In 1862, a Japanese junk was stranded in September near Attu. They had drifted in distress for 90 days, and out of a crew of twelve only three survived. These were taken in 1863 to Nicolaefsky, Amoor river, and then returned to Hakodaté by a Russian war vessel.

42. In 1862, May 4th, the ship *Victor*, Captain Crowell, arrived at San Francisco, with the captain, officers and crew, eleven in number, of the Japanese junk *Io-maru*, from Kanagawa, December 21, 1861, for Owari and Hiogo. On January 5, 1862, was disabled and drifted from land. Was about three months at the mercy of winds and currents, until picked up April 13th, 1862, in lat. 33° N., long. 161° 26′ E., by the *Victor*. They were cared for by Mr. Brooks, Japanese Consul, and by him returned to Japan, in the American schooner *Caroline E. Foote*, for Hakodaté.

43. A Japanese junk drifted past Baker's Island, lat. 0° 13′ N., long. 176° 22′ W., some time in 1863. Boats were sent out and towed it on to the beach. There were four Japanese bodies on board; all were dead.

44. In 1864, February 4th, on Providence Island, lat. 9° 52′ N., long. 160° 65′ E., on the Lagoon shore of the island was seen the portions of a vessel which had been many years a wreck. Scattered along the outer shore were many redwood logs, some of them of great size.

45. In April, 1869, an abandoned junk was stranded on Adakh, one of the Aleutian Isles.

46. In 1870, in October, the San Salvador ship *Louisa Canovera*, Captain Demoro, when in lat. 37° 46′ N., and long. 158° 10′ E., fell in with a dismasted junk, laden with rice, having four dead bodies on board, and no living persons. The papers and effects were taken and delivered to the Japanese Consul at San Francsico, and by him returned to Japan, November, 1870.

47, 48, 49. In July, 1871, the old chief at Attu Island, aged 70 years, reported that three Japanese junks had been lost upon the surrounding islets, during his recollection, besides one stranded not far from the harbor of that island in 1862.

50. In 1871, February 2d, in lat. 33° 45′ N., long. 141° 31′ E., about 150 miles from the coast of Japan, the American ship *Annie M. Smull*, Captain Packer, fell in with the Japanese junk *Sumi-yoshi-maru*, of Kiushiu, and rescued the Captain and three surviving seamen, and landed them at San Francisco, February 24, 1871. They sailed from Shiroko, province of Ise, January 17, 1871, for Dai Osaki, with a cargo of wood. Two days later they were disabled, and drifted to sea, and were picked up seventeen days later.

51. In 1871, May 23d, in lat. 34° 54′ N., long. 143° 32′ E., Pacific Mail steamship *China*, Captain Cobb, rescued five Japanese seamen from the disabled junk *Sumi-ayee-maru*, of Kobe. Eleven out of sixteen originally on

board died upon the wreck, and the captain of the junk died on the steamer after being rescued. They were cared for by Mr. Brooks, who returned them to Yokohama, July 1, 1871, and the government presented suitable rewards.

52. In 1871, the Japanese junk *Jinko-maru*, of Matsaka, of 180 kokus measurement, encountered a severe gale January 18, 1871, while going from Isé to Kumano, during which she lost her rudder, and while in danger of foundering cut away her masts. The junk drifted from the coast of Japan in the Kuro Shiwo for 2,500 miles in a helpless condition, her crew keeping a fire and living on rice, and fish they speared, until they drifted on the rocks at Atka, July 10th, 1871, where, by means of ropes, the three men on board landed safely. There they remained until September 19th, 1871, when they took passage by schooner *H. M. Hutchinson* for Ounalaska and San Francisco, whence they were returned to Japan by the Consul.

53. In 1873, Captain W. B. Cobb, in steamer *China*, rescued the crew from a wrecked junk in lat. —° —′ N., long. —° —′ E., and landed them at Yokohama, in acknowledgment for which the usual present was made him by the Japanese government.

54. A junk has been reported as stranded on the coast of Alaska.

55. A junk was cast upon the windward side of Kauaii, one of the Hawaiian Islands, and the survivors landed at Hanalei harbor.

56. An old resident of Petropaulski informed me there was a Japanese junk stranded below that harbor, previous to 1812, where many years since the wreck still remained. Six of the crew survived.

57. A Japanese wreck was sighted adrift below San Diego. Reported in the *Alta*.

58. A junk was wrecked at Nootka Sound.

59. In 1875, April 6th, in lat. 38° 02′N., long. 164° 38′ E., American ship *Game Cock*, Capt. T. C. Stoddard, fell in with the Japanese junk *Woonohi-maru*, of about 80 tons, dismasted, with her stern stove and rudder gone, and generally in a helpless condition, and rescued therefrom twelve Japanese seamen. The junk was bound from Hakodaté to Tokio, with a cargo of salt fish and sea-weed, when on December 3d they were blown off shore in a severe gale. December 10th they again made the land, when another heavy gale commenced and blew the junk off again. December 19th was forced to cut away the mast to save the hull. December 22d raised a jury mast and got under way, sailing towards Japan whenever the wind permitted; at other times took in sail and drifted. By their reckoning, they estimate having thus sailed 1500 miles west, principally with northeast winds, when, April 5th, in a bad sea, they carried away rudder, and soon after stove stern. At 8 A.M. the following day, they abandoned the wreck, from which they were rescued by the *Game Cock*, and landed at San Francisco April 28th, and were returned to Japan by Mr. Takaki May 1st, per *Great Republic*. For the rescue and kind treatment of these men, the Japanese Government presented Capt. Stoddard with a gold chronometer watch through His Excellency Yoshida Kiyonari, their Minister at Washington.

60. In 1876, July 3d, in lat. 37° 10′ N., long. 167° 35′ E., British barque *Abby Cowper*, Capt. Nelson, fell in with the Japanese junk *Koki-maru*, of Otaru, island of Yeso, of 477 kokus government measurement, equivalent to

about 120 tons. The junk was dismasted and floating in a helpless condition. Sakaki-bara Katsubé, mate, and Tomokitchi, sailor, the only survivors of 12 men, were rescued from the wreck, and made the following statement, which is very interesting as an illustration of many doubtless similar struggles. In October, 1875, the junk loaded at Shari and Abashiri, on the northern coast of the island of Yeso, with salted salmon and preserved roe of salmon. Left latter place November 5th, and touched at Hakodaté, whence they sailed December 6th for Tokio, Niphon. On the 9th, when on the east coast of Japan between lat. 39° and 40° N., and about long. 142° E., a severe westerly gale was encountered. December 12th carried away mainmast. Afterwards got it in and fished it with a piece of the main yard. On the 18th carried that mast away, and the yard was washed overboard. A sea soon after disabled the rudder, which was unshipped and taken in, the vessel in the meantime making water freely. To lighten her, 300 kokus of cargo (nearly two-thirds), was thrown overboard. From this time the vessel floated helplessly.

Early in January, 1876, fresh water gave out, and all the rainwater possible was saved and used. Then three seamen were taken down with the scurvy, which soon appeared among the balance. Towards the close of January, firewood gave out, but a small nucleus of fire was preserved in a stove. As a last resort, the junk's boat was broken up for firewood. All hands subsisting on a little rice cooked in rain water, and principally on salt fish, with a very small allowance of water. February 5th Chojero died—the first death. March 9th, Capt. Sato Sangoro died; then followed Kitsaburo, April 16th; Bunkichi, 21st; Kizo, 24th; Renkitchi, May 2d; Skedjero, 2d; Taské, 2d; Heihichi, 14th, and finally, Matsutaro, June 10th. The two survivors, anticipating a similar death, lingered until the forenoon of July 3d, when they sighted a vessel, had strength enough to raise a signal, and were rescued. They caught rain May 24th, after nearly all had died, which largely assisted in preserving the survivors. They also caught fifteen large fresh fish called *bonita*. Before the captain died, he wrote and handed to the mate letters to his family and owners, describing all details. The two survivors, expecting death themselves, boxed these up, with the ship's papers, and fastened them in a conspicuous place, whence they were taken and preserved. After the death of each person, the survivors enclosed their bodies in a Japanese coffin suitably inscribed, and stowed them in the hold of the junk, hoping they might reach some land and receive burial. The survivors reached San Francisco August 15th, 1876, and after recuperating, were returned to Japan by Mr. Takaki.*

Many more might easily be added, but these suffice to establish many facts valuable to science.

The annual rainfall of Japan averages 70.33 inches, occurring on 197.7 days, two-thirds of which falls between April and October; at Tokio the thermometer varies from a monthly maximum of 91° Faht. in August, to a minimum of 20° in January, averaging 58° 22 for the year, and averages 48° 33 at Hakodaté, where the average number of hard gales per annum is 16.79. [See Kaitakushi Reports and Tables, Tokio, 1875.]

*—Note.—These last two cases have been submitted by Mr. Brooks as additions to the list for publication since the reading of this paper.

The presence of wrecks so far south near the equator, indicates that they had been swept northward from Japan by the Kuro Shiwo, and thence southward along the northwest coast of America until they fell into the equatorial westerly current, where, in company with redwood logs, and drift-wood from Oregon, they must have reached these islands in the equatorial belt.

In illustration of this equatorial current, we have the report of residents of Christmas Island, which speaks of a westerly current setting past that island at the rate of one and a-half to two miles an hour. August 23d, 1861, there was picked up on the shore of the island of Niihau, in latitude 21° 50′ N., longitude 160° 15′ W., a bottle containing a paper, thrown from the American ship *White Swallow*, thrown overboard July 21st, 1861, in latitude 21° 30′ N., longitude 151° 55′ W. It had made a nearly due west drift of 460 miles in about thirty-three days. This shows the existence of a very powerful westerly current around the Hawaiian Islands of about 14 miles per diem.

In 1862, September 10th, an enormous Oregon tree about 150 feet in length and fully six feet in diameter above the butt, drifted past the island of Mauii, Hawaiian Islands. The roots, which rose ten feet out of water, would span about 25 feet. Two branches rose perpendicularly 20 to 25 feet. Several tons of clayish earth were embedded among its roots. Many saw-logs and pieces of drift-wood came ashore in this vicinity about this time. These were evidently portions of the immense body of ship-timber launched upon the Pacific during the great flood of the previous winter along the American coast. Their almost simultaneous arrival at Mauii in September, seems to indicate quite accurately the force and direction of the currents in this ocean. Supposing them to have come from the Columbia River, leaving say February 18th, 1862, and to have drifted 2,800 miles, they must have drifted at an average rate of 14 miles per day to have reached Mauii September 10th.

We may argue from the above that there were other ways of explaining the similarity of flora upon many islands of the Pacific and the high terraces of our Sierra Nevada mountains, beside the hypothesis of an intervening continent where the broad Pacific now rests.

There is a strong presumption that the present bed of the Pacific Ocean may once have been an extended valley, submerged by some abrupt and spasmodic catastrophe, at a period when the fiery interior of the earth was in a state of inconceivable agitation, and its equilibrium temporarily disturbed. Abundant ruptures of the entire combined strata of its crust along our mountain ranges, bear indisputable evidence, in prominences tilted up and raised to immense heights: conditions which must have necessitated corresponding depressions, and consequently established new beds for water, forming new islands, re-dividing and re-shaping continents. The existing shore lines of enormous empty basins, the pebble and cobble stones rounded by erotion, at present in the centre of this continent west of the Rocky Mountains, all contribute testimony of some great change.

The spores or seeds of plants may, however, have been more recently transferred by clinging to the earth around the roots of such mammoth trees as floated from the high latitudes of the northwest coast of America. Once cast upon any island and rooted, they would soon replant and extend themselves. Driftwood from Columbia River and Puget Sound distributed itself

throughout the North Pacific, and the windward shores of the Hawaiian Islands are literally lined with it, as well as with redwood logs of formidable size.

Small parties of male Japanese have repeatedly reached the American continent by sea, cast upon its shores after floating helplessly for months. Until recently, the survivors must have remained permanently near where they landed, and naturally uniting with women of the native races, have left descendents more or less impressed with their physical peculiarities. Such a slow, limited, but constant infusion of Japanese blood, almost entirely from male seamen, was undoubtedly sufficient to modify the original stock of all coast tribes along our north-western shore. No marks exist of any immigration *en masse*, neither is there any present record of any Japanese woman saved from such a wreck, although cases may formerly have occurred, but must have been very rare. These unfortunate seamen, often illiterate, and separated from their sources of learning, necessarily lost their own language; but in doing so, doubtless contributed many isolated words to the Indian dialects of this coast. Many shipwrecked Japanese have informed me that they were enabled to communicate with and understand the natives of Atka and Adakh Islands. Quite an infusion of Japanese words is found among some of the coast tribes of Oregon and California, either pure, as *tsche-tsche*, milk, or clipped, as *hiaku*, speed, found reduced to *hyack*, meaning fast, in Indian; or *yaku*, evil genius in Japanese, similarly reduced to *yak*, devil, by the Indians. In almost all words showing such similarity, the Indian word is always an abbreviated word, or shorter word than the Japanese, from which it may be argued that the latter was the original and the former derived. The construction of the two languages is, however, different. There are, however, a large number of pure Japanese words and some very peculiar Japanese "idioms, constructions, honorific, separative, and agglutinative particles" found nearly identical in the American-Indian dialect. Shipwrecked Japanese are invariably enabled to communicate understandingly with the coast Indians, although speaking quite a different language. The great mass of the Japanese people stoutly disclaim any common descent with the Chinese, and firmly believe they have a wholly different origin. Any common ancestor must certainly have been in very remote ages.

Professor George Davidson, in charge of the United States Coast Survey on the Pacific, our highest authority upon questions connected with the great ocean currents of this ocean, has bestowed much critical study upon the physical conditions connected with the Kuro Shiwo. In 1851, when stationed at the mouth of the Columbia river, he began the interesting investigations necessary to demonstrate its complete outline.

In 1868, he communicated to the National Academy of Science his deductions establishing the existence of the return current northwestward, westward and southwestward along the shores of the Gulf of Alaska, and the southern coast of the Aleutian Islands, whilst the great body of the current is deflected down the northward coast until it is drawn into the Great Equatorial Current which moves westward until it strikes the Asiatic barrier, and thence starts on its course, about the island of Formosa, as the great warm stream of Japan. He first showed the striking analogy between this stream and that of the

North Atlantic, especially in their origin at latitude 23°, their being nearly 180 degrees of longitude apart, their general course, etc., etc.

There is a branch of the Kuro Shiwo, which shoots off northward near Kamschatka, and is felt 50 or 100 miles off this promontory; whilst close in shore, a cold current flows southward from the Arctic through the western part of Behring's Straits. On Kamschatka, the Kurile and Aleutian Islands, and on Alaska, great number of disabled Japanese junks must have been stranded in past centuries.

Professor Davidson, who has had occasion to examine the Spanish, English, Russian and American records of discoveries in this ocean, assures me that he has found mention of at least a dozen or more junks, wrecked on the coasts of Kamschatka, within a comparatively recent period; and in the earlier descriptions of the Kurile Islands, and of the Kamschatka Peninsula, he says frequent mention is made of the wrecks of Japanese junks upon these coasts.

Both winds and currents of the North Pacific assist in driving disabled Japanese junks around the great circle of the Kuro Shiwo. A junk disabled in the latitude of Tokio would be swept by alternate southwest and northwest winds, and the existing northeasterly current, towards the northwest coast of America. The distance from Cape King to San Francisco is about 4,500 nautical miles. We have here abundant proof of the track taken by these disabled vessels, by a study of their positions when found drifting at sea in the Pacific, at the mercy of winds and waves.

For many, many centuries the coasting trade of Japan has employed a large fleet of junks in exchanging rice from their southern, for salt fish from their northern ports. Although it may be presumed that the large number of their vessels thus disabled and rendered unmanageable, undoubtedly founder in the heavy gales they experience; yet comparatively large numbers having cargoes suitable for food, and crossing a region subject to much rain, which is easily caught, are enabled to sustain life until either picked up, or stranded somewhere on the American coast, or some island in their course.

In the above sixty cases enumerated, there were, from 1613 to 1694, four cases; from 1710 to 1782, three cases; 1804 to 1820, six cases; 1831 to 1848, eleven cases; and since the rapid settlement of this coast in 1850 to 1876, only 28 years, we have a list of 36 wrecks reported. This apparent increase is not owing to their increased number, but solely to the fact, that increase of commerce on the Pacific has distributed there a large fleet, whose presence has materially increased the chances of rescue to disabled vessels, and the likelihood of receiving reports from stranded wrecks.

In addition to the list we have enumerated, are the Hawaiian traditions that *several* such junks were wrecked on Hawaii before the year 1778; to which add the wrecks from which the 18 Japanese were returned from Honolulu in 1834, also those from which came the junk full of shipwreck Japanese, who attempted to, and failed in returning, by Cheefoo to Nagasaki; also the dozen additional ones, alluded to by Professor Davidson, as stranded on the peninsula of Kamschatka, within a comparatively recent period; and the frequent mention of similar wrecks on the Kurile Islands. These all taken together, with yet others not fully verified, could scarcely have been less than forty

more, rendering it reasonable to suppose that fully one hundred wrecked Japanese junks, have been heard from, in one way or another, adrift upon the North Pacific, or stranded on the northwest coast of America or some outlying islands.

In answer to the question of whether any of these waifs have ever found their way back to Japan from the American coast, in early times, I can say, that from historical data still extant, and from the personal relations of descendants of some of such returned voyagers, I have learned that in rare cases, occurring from 400 to 260 years ago, crews actually reached Japan with tidings of the American coast; and Professor Davidson informs me, that when recently in Japan observing the Transit of Venus, a very intelligent Japanese scholar, well known to me personally, related to him a well authenticated case within this century. Formerly such accounts were not allowed general publicity, because stoutly discountenanced by an ecclesiastical government, to whom such discoveries were quite as repugnant as were Galileo's to the medieval government of Rome. To the peaceful masses, the confines of their archipelago, were but recently the horizon of the world.

The famous voyage of the Buddhist priest from China, at the beginning of the seventh century, to a country called by him Fusang, (meaning, translated "to aid or cultivating mulberries,") was at the exact period when Japanese historians record their first official intercourse with China; and was probably reached by a coasting voyage along the western coast of Corea, thence along the northern coast of Niphon, around Yeso, and southerly, to the southeastern shore of Niphon, where mulberry trees were then cultivated abundantly, and which was undoubtedly the land he called Fusang. A careful study of the native records seems to indicate that his much mooted Chinese voyage could not possibly have extended to the American coast.

Of the sixty cases here reported, 27 wrecks were encountered at sea, and the balance stranded, as follows: On the Aleutian Islands, 8; Coast of Kamschatka, 6; Alaska, Oregon, Hawaiian and Brooks Islands, two each; Off San Diego, Acapulco, Nootka Sound, San Bonito, Queen Charlotte, Cedros, Providence, Baker's, Stapleton, Ocean and Ladrone Islands, one each.

In 23 cases where the actual number on board was named, they aggregated 293 persons; an average of 12¾ persons to a junk; ranging from 3 to 35 in individual cases.

Where definite statistics of the saved are given, we find 222 persons saved in 33 cases; an average of 6¾ persons in each disaster. On eight occasions, three persons each were rescued; in four cases, one person; and on four other cases, four persons; three times, eleven were saved; and twice each, 5, 12, 15, 17; and once each 2, 6, 7, 9, 10, 13, were saved.

By an examination of the above figures, we may estimate the probable extent of Japanese blood infused into the Indian tribes around the shores of the North Pacific.

Fifteen vessels mention having drifted helplessly at sea an aggregate of 106½ months, averaging a little over seven months each.

Eleven cases report 122 deaths; averaging a little over eleven deaths to each wreck.

It is sincerely hoped that the publication of this record, which has so interesting an ethnological import, may result in awakening Japan to the adoption of immediate steps in the great interest of a common humanity; for by improving the models of her vessels, and adopting those with sea-going qualities, this long record of disasters may speedily be abridged, if not wholly terminated.

About a year since it became my duty to forward to Japan, half a dozen wooden models, full drawings and specifications of small vessels, varying from 40 to 200 tons, ordered by the Japanese government for the use of shipbuilders, which the now enlightened government has recommended them to adopt, instead of their present form of junks. Thus the edict of 1639 has passed away forever, and young Japan is rising to take her equal place among the advancing nations of the world.

Few are better aware than the scientist, of the manifold and inevitable dangers which attend all radical changes, when suddenly made; for success is a problem seldom solved without repeated trials and inevitable failures. But to-day, Japan is earnestly seeking to establish her national perpetuity, by fostering a discriminating intelligence among her people, and by encouraging general and liberal education among the masses. Thus she reverses in the most practical manner, the other edict alluded to as promulgated in 1637. Her centuries of quiet seclusion are now embalmed with the history of the past, and she seeks true greatness in an enlightened administration of her national affairs, and bids fair henceforth to reciprocate a generous friendship towards all members of the great brotherhood of nations, from whom she may now claim equal sympathy and neighborly protection.

The great changes in Japan can not be better illustrated than in the fact, that it is now customary for the government of Japan, in common with all other nations, to present through their Foreign office, some suitable reward in acknowledgement of kind service, to the captains of vessels who rescue their shipwrecked seamen.

The Japanese Government have now in their navy ten war ships, five dispatch vessels, and five training ships, all steamers; and in their mercantile marine, one hundred and two steamers of various tonnage, aggregating 30,718 tons; also 32 modern sailing vessels built in foreign style of 7,346 total tonnage.

The great Pacific Ocean and its adjoining waters, under the impulse of this age of steam, is becoming the highway of an enterprising commerce, and steadily unfolds an attractive field of research to ethnological and linguistic archœologists.

Many young Japanese are already attracted to scientific pursuits, and their valuable technical as well as general results, are beginning to claim the attention of naturalists.

Much valuable scientific work has been done by Japanese scholars since their early lessons received from Professor Wm. P. Blake and Professor Raphael Pumpelly; two eminent American scientists, whom I had the honor

of selecting and engaging in the summer of 1861, on behalf of the government of Japan, to act as government Mineralogists and Mining Engineers.

A glorious opening now presents itself for some reliable and competent scholar, with pecuniary means at command, to collect a library of books relating to the Asiatic shores of the North Pacific ocean, as perfect in its way as is that of our great historian, Hubert H. Bancroft, relating to the native races of the American coast; and when as systematically classified, and as thoroughly studied, give to the world full and correct historical details and analytical classifications of all native races on the borders of Asia; many of whose records and traditions must necessarily fade with radical changes in civilization, and soon pass beyond human reach.

The splendid sunrise, now dawning in the Orient, offers golden opportunities, which should be promptly improved while available. Old ways are giving place to new, and invaluable treasures of antiquity may be lost forever, or cast aside to linger for a generation or two, in the memories of the aged, before their shadowy forms become enshrouded in the misty veil of a forgotten past.

Dr. Stout referred briefly to the death of Sir Charles Lyell, and a Committee of three was appointed to draft appropriate resolutions. The Chair appointed John Muir, H. G. Hanks, and Dr. A. Kellogg.

Regular Meeting, March 15, 1875.

Vice-President Gibbons in the Chair.

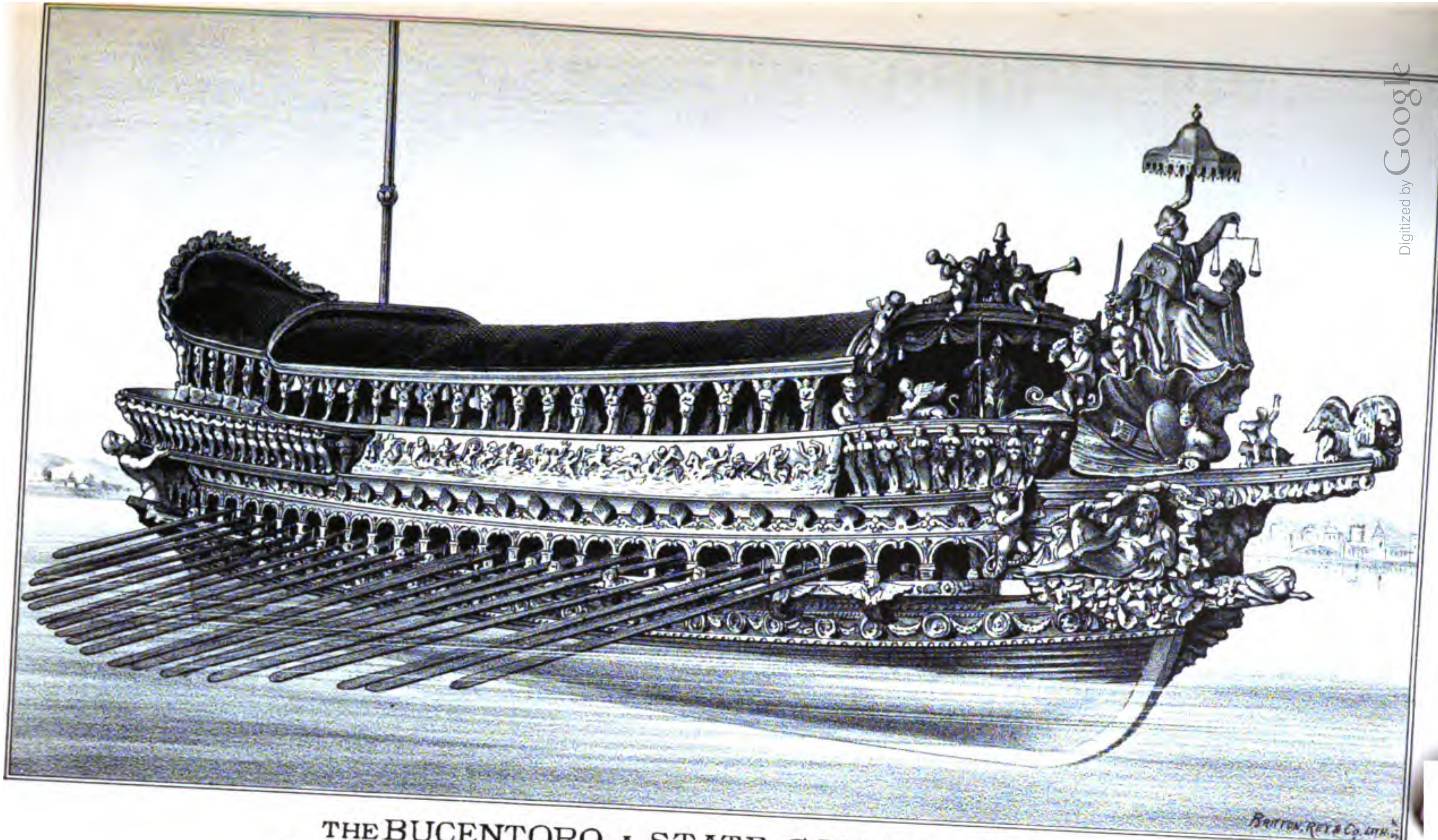
Twenty-two members present.

Henry R. Taylor and J. W. Anderson were elected resident members; and Arthur C. Taylor was proposed.

Donations to the Museum: From John Muir, lava from Mt. Shasta; also specimens of *Pellea ternifolia* and *Cupressus McNabiana*.

Mr. Amos Bowman read a paper on Terraces in the Coast Range as related to the detritus of glaciers and of the ancient rivers.

Charles Wolcott Brooks read the following paper:



THE BUCENTORO, A STATE GALLEY OF VENICE.
gilded from prow to stern, and covered with a canopy of silk

Early Migrations—Ancient Maritime Intercourse of Western Nations before the Christian Era, Ethnologically considered and Chronologically arranged, Illustrating Facilities for Migration among early types of the human race.

BY CHARLES WOLCOTT BROOKS.

In all subdivisions of races, we are apt, at first, to look superficially upon different nations as separate and complete types of humanity. The brief synopsis here collected from ancient histories, clearly reveals the extent of maritime intercourse, actually developed by western nations up to fully 4,000 years ago. By such statistics, acquired with sufficient details to trace facilities for admixture, the inference fairly follows: that maritime nations of Asia, including the Japanese, whose origin we are soon to examine, may have enjoyed like facilities of intercommunication; and consequently, in common with all maritime peoples at this stage of human existence, became to a certain extent mixed and composite.

Until we reflect, we know not the possibilities of human nature. The exact justice of all nature's arrangements, and the unerring actions of her laws is exhibited in her method of developing man. He is carniverous, hence combative; gregarious, therefore social. This is equally true of individuals and of nations. If we follow out this thought, we shall find man, even in his perturbations, is a creature of law.

All matter is similar in substance, differing only in degree of development. The refinement of matter is a process ceaselessly going on in the Eastern as well as in the Western hemisphere; for the parental law of physical and mental formation, and progressive development is universal, coëxtensive and coëval with nature, No solitary world or people has a special code of laws. God, the controlling power, is law, impartial and universal. Man is the highest physical ultimate of matter endowed with a progressive principle. To him, religion is a grand, progressive, moral science, unfolding his physical and mental qualities by exact and eternal law. It everywhere teaches him that the aspect of all created things is continually changing, and in obedience to law he *must advance*, for all present conditions periodically perish. With constantly changing conditions, an endless evolution of forms and ideas is ceaselessly occurring.

Nature is everywhere instinctive with life; attractive and repulsive forces are exerted over atoms and bodies, and equally over minds. These, in the latter case, influence migrations. Capricious influences often intervene to determine direction; for nature works by greater or lesser impulses, yet her methods determined by law, are always adapted to the end in view, to the plan of the Great Architect, the Intelligent Mind of the Universe.

Perfect arrangement and maturity of plan marks the order of creation. Life is to unfold, cultivate and develop our rudimentary powers. Every atom bears its own record. Our own soul is the parchment, whereon is indelibly engraved our virtues and our vices. Action and rest succeed one another. Periods of intense activity are succeeded by others, either dilatory or inert, when action gradually subsides. The world is now entering a period of great popular activity.

Language is inadequate to convey a perfect idea of a spectacle, open to the analytical eye of every observing naturalist; sublime as it is wonderful, exact as it is impartial. All things are subservient to exact law, and similar conditions lead to similar results. An elementary study of the early intercourse among so-called western nations, seems imperative to those who would seek to unravel a corresponding movement among aborigines of the far East.

The independence of thought and action, which this age has developed, precludes the acceptance of any theory by the educated classes, which is not in accordance with nature and reason. Only by practical illustrations can we properly comprehend nature's intricate principles and processes. Science says: prove all things, all truth is susceptible of proof.

Although many individual instances here quoted may be familiar to scholars; their ethnological value is especially apparent when massed in one collection, where they show early intercourse to have been habitual rather than exceptional, revealing the probability as well as the possibility of very early admixture of races, and finally elicit testimony to establish a certainty.

From the earliest dawn of human history, tribes and nations appear to have been more or less mixed, either when captured as prisoners of war, like the Sabine women of Rome, or united in friendly alliance for purposes of commerce. General communication, here shown to have extensively occurred during the early stages of human development, naturally implies that all early races brought in contact by commerce, have to a certain extent, mutually left their impress upon each other.

Before submitting the ancient records of Asia to a scrutinizing search, we briefly trace the early footsteps of national intercourse in the histories of western nations. Gradual progression marks the development of commerce, from the rude attempt of the ancients to follow their coast with primitive galleys, having solitary mast and sail, or oars double or treble banked, to the dauntless energy of ocean steamships at the present day. Slowly but surely commerce is raising inventive genius above the fame of military chieftains, and enabling Watt, Fulton, Arkwright, Whitney and Morse, to claim a greater share of our true admiration, than agents of destruction like Alexander, Cæsar or Genghis khan.

Maritime commerce, which exchanges what a nation can spare from its abundance, for what it wants, is of very ancient origin, and may have had its beginning in the unrecorded era, nearly coëval with the development of intelligence in man.

The study of astronomy, a science essentially necessary to ocean navigation, was very ancient among oriental nations. Learned astronomers are persuaded that the celestial observations of the Chinese were accurately taken B. C. 2249; those of an eclipse, B. C. 2155, have been proved as authentic, and

other observations are recorded three centuries later. Astronomical observations made at Babylon, calculated the rotundity of the earth, which they estimated at 40,000 miles in circumference; and those when transmitted to Greece by Alexander, and seen by Aristotle, B. C. 324, contained a calendar of above nineteen centuries, extending back to within fifteen years of those ascribed to the Chinese. Europeans first learned this science from Jupiter Belus, king of Babylon. The ancient kingdoms of India appear to have had observations fully as early as the Babylonians.

We will now attempt to trace chronologically the naval growth and ancient commerce of western nations by their records, from B. C. 2249 to the Christian era, to demonstrate the possibility of early migrations of races in prehistoric times. Migrations by water, which appear by our own histories to have occurred around the Mediterranean, may likewise have occurred on the Pacific, and in other parts of the habitable globe. Shore lines and water courses were early availed of for the distribution and subdivision of races. Mountain ranges were natural barriers.

The authenticity of ancient history necessarily rests upon the evidence of ancient writers, when unimpaired by later discoveries. This summary has therefore required a judicious digest of many original authors, from whom its statistics are compiled and arranged.

Few seem to be aware of how early and extended an intercourse existed between Asia and the western world, which in its earliest ages was principally conducted by the South Arabians, a people apparently more enlightened by science and commerce than any nation farther East except the Phœnicians.

The South Arabian commerce is supposed to be the most ancient intercourse between far-distant peoples, of which western nations have any remaining records. That next in importance, and apparently also in order of time, was that of the Phœnicians and their colonies, especially Carthage and Gadir (changed by the Saracens to Cadiz). Those general enemies of commerce, the Romans, soon abolished that of Cathage and of Corinth. With the increase of the Roman empire came the decrease of commerce, excepting only that branch necessarily enlarged by an increasing demand for Oriental luxuries. Of this very early trade of the Europeans and nations of Asia Minor, with the Orient, we happily possess a description which, for accuracy and minuteness of detail, when compiled, may almost rival a modern official account.

As the Roman empire declined, the Oriental trade, supported merely by the redundant opulence of Rome, gradually decayed; and in the sixth century we find the intercourse with India turned into a new channel. During the many dark ages which succeeded the subversion of the western empire, gross ignorance prevailed, and commerce, in common with literature and science, became neglected in the western hemisphere, until renewed attention was drawn to it by the Saracens, and at some of the Italian seaports. The spirit of commerce afterwards arose in the Netherlands and at some German seaports, followed by Portugal and Spain, and latterly by Great Britain and other European nations.

The Greeks esteemed Phœnicians as the inventors of commerce, shipbuilding, navigation, and the application of astronomy to nautical purposes; their

capital, Sidon, founded about B. C. 2200, became preëminently great and illustrious for the wonderful energy of its people, but it is presumed that commerce was received by the Phœnicians from the Babylonians, and in turn found its way there from Indian countries farther East, along the Asiatic shore and Malayan archipelagoes.

That Persian poem, the book of Job, generally admitted to be the oldest book in the Hebrew bible, shows that sciences were then cultivated, ship-building, useful and ornamental arts, were in an advanced state, and commerce was vigorously prosecuted. Vessels are spoken of as distinguished for their speed, bringing gold from Ophir, and topazes from Ethiopia.

B. C. 1728, the Arabians conducted an extensive and profitable trade between Egypt and India, importing largely of spices, gold and silver; and it is recorded, B. C. 1556, that vessels were propelled by fifty oars. This custom continued, and in later history we find their size increased, and they were furnished with three, and at times five, tires of oars.

The early history of Greece shows their vessels were Phœnician built, rowed by oars—long, slender, open boats, lightly constructed, capable of being transported upon shoulders, the smallest carrying 50 men, the largest 120—and although they had masts and square sails, they depended mainly upon their oars. Seventy geographical miles was considered a day's work for a vessel with oars, and the sailors were paid four *oboli*, or about eight cents a day.

Much of the early Greek mythology came originally from India. There is scarcely anything the Greeks ever learned from the far Orient, the invention of which they have not ascribed to their own countrymen. Many of our best scholars, aided by recent discoveries and researches, are now persuaded that the use of letters was known to the Greeks before Cadmus came from Phœnicia, B. C. 1556. The earliest letters known in Greece were more probably those which Plato calls Hypoborean (i. e. northern), and describes as different from letters of his own age. According to Diodorus Siculus, Orpheus used Pelasgic letters, which were older than the Greek.

Strabo says: the invention of rafts, the very first rude essays in navigation, was ascribed to Erythras, a king of some part of the coast of the Persian Gulf. Theophrastus is, I believe, the oldest author who alludes to cinnamon and other spices and aromatics, knowing them to be the produce of India. Intercourse between India and Arabia was easy by availing of the monsoons, whose periodical regularity were observed and taken advantage of, to bring cargoes of spices many ages before the time of Hippalus, whom the Egyptian Greeks supposed to be their first discoverer. The Southern Arabs traded to more remote parts of India than the Persians or Assyrians, and from the earliest ages enjoyed most generally the entire monopoly of the trade between far India and the western world. It was not until Europeans found an ocean route to India via the Cape of Good Hope, that the ancient system of their most important commerce was totally overturned.

This commercial history is quoted as showing how common and easy was the migration of colonies by sea in remote ages, and how great an ascendency the possession of shipping and maritime power gave to some of the pre-historic races. In very early times the Phœnician merchants were the greatest

ocean carriers for the whole western world. B. C. 1280, the spirit of trade is recorded as having spread over the greater part of Asia.

The religion of Egypt declared the sea unclean, because the dead body of their god Osiris was thrown into it. Egyptians therefore abhorred the sea, and formerly avoided any concern in maritime affairs. Their early trade was conducted by foreigners; on the Mediterranean and with Arabia, their commerce was for a long time wholly entrusted to the Phœnicians. According to Apollonius Rhodius, B. C. 1300, and prior to the expedition of the Argonauts, Sesostris, king of Egypt, built a fleet of 400 vessels on the Erythræan (Red) Sea. The Egyptians were, however, but fresh-water sailors; their hulls and masts were made of *thorn*, and sails of paper.

The Greeks had skillful ship-builders, and Homer has immortalized Harmonides as the builder of the vessels which carried off the beautiful Helen from Sparta. During the "heroic ages" of Greece, the petty princes on the sea coast frequently fitted out vessels to go on piratical cruises against the merchant ships upon the Mediterranean; hence it became common to question a commander whether he professed piracy or trade.

Their course depended on the previous knowledge of the shore acquired by some member of the crew. Homer describes Ulysses as covering his ship with long planks, making probably a half-deck.

B. C. 1194, when Paris carried off Helen, wife of Menelaus, king of Sparta, Agamemnon, king of Argos, embarked a Grecian army of 100,000 men in a fleet of 1186 vessels to avenge the affront.

Castor, of Rhodes, a writer cotemporary with Julius Cæsar, made a catalogue of nations who successively attained the empire of the (Mediterranean) Ægean Sea. B. C. 1280, the island of Crete was called by Aristotle the Empress of the Sea. B. C. 1179, the Lydians, after the Cretans, were honored by Minos with the title of masters of the sea. B. C. 1058, the dominion of the sea is ascribed to the Pelasgi. B. C. 1003, Castor alleges the Thracians had the *Empire of the Sea*, and held it 19 years. B. C. 890, the dominion of the sea is ascribed to the Phrygians. B. C. 753, the Milesians are represented as supreme in naval power, and having a wide commercial fame. B. C. 734, the dominion of the sea is ascribed to the Carians, buccaneers, noted for their piracies. B. C. 717, the Corinthians, a nation of Greece, made a considerable figure in naval transactions. Thucydides mentions their naval force soon after the Trojan war, kept up to protect their trade against pirates. B. C. 676, the Lesbians obtained and held command of the sea for 59 years. B. C. 67, the Romans were masters of the sovereignty of the sea without a competitor, having destroyed nearly all the mercantile nations.

B. C. 1100, the Phœnicians extended their discoveries along the entire northern coast of Africa and the opposite shores of Spain. The Mediterranean was no limit to their enterprise, for they passed the Pillars of Hercules (Gibraltar) and established powerful commercial settlements upon the Atlantic, mutually beneficial to themselves and natives of the country. Phœnician colonies were societies of opulent and intelligent merchants, ingenious manufacturers, skillful artizans and hardy seamen, who left an overcrowded population, with the good wishes of their parents and friends, to settle in a distant country and there maintain a correspondence for mutual advantage.

B. C. 1046, Eupolemus says David built ships in Arabia, wherein he sent men skilled in mines and metals to the island of Ophir.

B. C. 1012 and 975, Solomon extended his territories to the Red Sea, and despatched ships to the rich countries of the South and far East. Hiram, king of Tyre, wishing an opening to the rich commerce of the Orient, either acted in partnership or concert with him.

Previously all Oriental products had been received at second-hand through the Arabians. Solomon's ships, built and conducted by the Tyrians, sailed in company with those of Hiram to the rich land of Ophir and Tarshish. A voyage required three years to accomplish, and the returns were prodigiously profitable, consisting of gold, silver, precious stones, ivory, woods, apes and peacocks. They probably availed of the monsoons to visit Ceylon, Sumatra, India, and possibly communicated with China and Japan. The Phœnicians, when in the Indian Ocean in company with Solomon's fleet, doubtless saw the beautiful Malay prows, and reported and improved upon the former models of their vessels, and multiplied their oars or paddles.

B. C. 916, the Rhodians composed a Code of Maritime laws, which was copied by the Romans, and ingrafted into the law of Oberon, which is in a great measure in force to this day. They were of Phœnician origin.

B. C. 890, the Greeks received from Asia coined silver money, weights and measures.

B. C. 717, the commercial city of Tyre was attacked by Salmanasar, king of Assyria, who brought against it a fleet of 70 vessels, furnished and manned by Phœnicians. The Tyrians defeated this fleet with only 12 ships, and took 500 prisoners. This is the most ancient naval battle recorded in European histories.

B. C. 700, great improvements were introduced into shipbuilding by the Corinthians.

B. C. 641, Colæus, of Samos, sailed through the Straits of Gibraltar to Tartessus on the southwestern coast of Spain, and was the first Greek who ever saw the Atlantic.

B. C. 616, Necos, king of Egypt, sent a fleet of discovery to circumnavigate Africa, engaging therefor Phœnician navigators who sailed by the Red Sea, and following the coast of Africa, returned by the Mediterranean, reaching home the third year after their departure.

B. C. 594, according to Diodorus Siculus, Apries, king of Egypt, had a fleet on the Mediterranean, and fought a naval battle against the maritime cities of Sidon and Tyre, the former of which he captured, beating the fleets of Phœnicia and Cyprus, and returned to Egypt loaded with spoils. As Egypt had no ship timber, most of the Egyptian fleets were built by, and purchased of, the Phœnicians.

B. C. 588, The Tyrians employed workmen from all neighboring countries to labor in building and navigating their ships, which were magnificently adorned with ivory, purple and fine linen; their commanders were most respected, and every commercial and maritime calling was esteemed honorable.

About this time, Thales, a Greek philosopher descended of Phœnician parentage, pointed out to the Greeks the *Ursa minor*, by which Phœnicians steered their course at night; instructed them in the rotundity of the earth; fixed the year into 365 days, and predicted the year of an eclipse.

Pythagoras, a native of the island of Samos, taught the rotundity of the earth, the existence of the antipodes, and a confused idea of the real motion of the planetary system as afterwards demonstrated by Copernicus.

B. C. 550, the Phœnicians visited Ireland, and returned with reports of the islands now known as Great Britain.

B. C. 543, we learn that the inhabitants of Phocæa, a Grecian city on the Asiatic coast, were a commercial people, and the first Greeks who traded to remote Asiatic countries; performing their voyages in long vessels of fifty oars, in the management of which they were very expert. Strabo mentions a colony of Phocæans who were expelled from Corsica, who sailed to the south of Gaul, where, B. C. 538, they founded Massilia (Marseilles), a city which about the Christian era, sustained a high character as the seat of science, commerce and naval power.

The Etruscans and Etrurians, says Didorus Siculus, founded colonies at a very early age, were good mariners, and appear to have possessed the greater portion of Italy before the Trojan war. Polybius says, B. C. 524, the Carthagenians were possessed of hereditary preëminence in nautical science. Their ships were equal to any on the Mediterranean, carrying carved figure heads and sterns. Aristotle says they were the first who raised their ships of war from three to four rows of oars. They constructed wet docks, and were first to appoint second captains (mates) to their vessels.

B. C. 524, the Carthagenians embarked 30,000 people in sixty ships of fifty oars each, and passed Gibraltar to the west coast of Africa to found colonies. These vessels must have carried 500 persons each.

B. C. 506, Darius, king of Persia, invaded the Scythians with a fleet of 600 vessels. Darius was also sovereign of Phœnicia.

B. C. 497, the Ionian fleet of 353 vessels was defeated by 600 ships belonging to the maritime vassals of Persia, chiefly under the direction of Phœnicians.

B. C. 494, an expedition, conducted by Mardonius, son of Darius, composed of 300 ships, containing 20,000 soldiers, was cast away against the rocks of Mount Athos during a violent storm.

B. C. 481, Xerxes, the mighty monarch of Persia and a greater part of Asia, sent a memorable expedition against Greece, composed of 1,207 *triremes*, or ships of war, carrying three *tires* of oars, and 3,000 transports, which formidable armada was finally defeated by the Greeks.

B. C. 477, Herodotus says, Amilcar a Carthagenian general, invaded Sicily with an army of 300,000 men. As Sicily is an island, this necessitated a naval fleet.

Frequent mention of large naval fleets transporting armies, is made from this date until the Christian era. From this time wide commercial intercourse existed,and many naval engagements of great magnitude are noted.

The commerce which had flourished for ages in the hands of the Phœnicians was largely desolated by the conquests of Alexander, B. C. 333.

B. C. 260, the Romans, who prospered for a while by a perpetual violation of justice, resolved to establish a naval force for piracy and commercial plunder. They had neither ship carpenters nor seamen, but got possession of a stranded Carthagenian *quinquereme*, and in sixty days from felling the trees,

their carpenters had constructed a fleet of 100 quinqueremes and 20 triremes. Roman sailors were drawn from the despised classes of the populace, and were unrespected, while the navigators and seamen of Tyre and Carthage were held by their people in high and deserved esteem.

B. C. 242, although the Romans had considerably improved in nautical knowledge, the progress of Science among them was very tardy, and their losses by storms at sea were prodigious. In one gale almost every soul perished on 384 of their ships, which either foundered or were wrecked. At the same time the Carthagenian fleet made a good harbor and escaped damage. The haughty Romans thought commercial concerns beneath their dignity, and that extended selfishness which they called patriotism, soon rendered it impossible for any mercantile nation to flourish within the grasp of Rome.

B. C. 219, superabundant wealth induced a rage for shipbuilding, among Hiero, king of Syracuse, and other opulent kings of his age, vastly exceeding every purpose of utility in enormous bulk and extravagant ornament. Assisted by Archimedes, Hiero constructed a galley of twenty tires of oars, sheathed with sheet lead, and carrying three masts, which no vessel had hitherto done. She had the embellishments of a palace with the fortifications and warlike stores of a castle. Athenæus tells us, on the authority of Callixenus and Mosepion, that Ptolemy Philopator, king of Egypt, built two huge ships. One intended for sea service was 420 feet long, 57 feet beam, consisting of two long flat vessels united by one deck, having two heads and two sterns. She carried 4,000 oars, disposed in 40 tires. Besides 4,000 rowers, she carried 2,850 soldiers, cooks, servants, etc. The other vessel, intended for inland navigation, was 300 feet long and 45 feet beam.

B. C. 170, the Sabæans, who possessed the southern extremity of Arabia, acquired great opulence by commerce, and preserved their liberty unimpaired by conquest during many ages. Agatharchides says they were in possession of the carrying trade between Asia and Europe, and commanded the commerce of both. They filled the dominions of Ptolemy with gold and silver and precious stones (probably from Ceylon), and founded several colonies in foreign countries.

B. C. 146, the Romans, determined upon the total abolition of commerce, destroyed the mercantile city of Corinth, and thought themselves entitled to the exclusive privilege of plundering the world.

B. C. 100, Strabo repeats a story of a vessel from India, picked up adrift in the Red Sea, with only one man aboard, almost dead, whose shipmates died of famine, and Ptolemy Eurgetes, II, king of Egypt during the Macedonian dominion, sent Eudorus to convey him back to India, whence the expedition returned with aromatics and precious stones.

B. C. 67, Pompey, with 500 Roman ships under his command, captured 400 ships at Cilicia.

B. C. 66, Lucullus, returning from Asia, brought as a part of his plunder, a large number of books.

B. C. 57, the Veniti, said by Strabo to be a Belgic nation, settled near the northwestern extremity of Gaul (France), were distinguished for their nautical science and experience. They had great numbers of vessels, excellent sea-boats, used leather sails, and iron chains instead of rope cables, and car-

ried on a considerable trade with Britain. Their fleet of 220 such vessels was overpowered and captured by a Roman fleet of 600 galleys.

B. C. 54, Julius Cæsar collected above 800 ships and landed a large force in Britain, subduing a great many kings, four of whom were in Kent.

B. C. 43, the profusion of luxury introduced into Rome by the conquest of enervated kingdoms of Asia, had now made alarming progress.

B. C. 25, ambassadors are said to have been sent by an Indian prince called Porus, from India to Rome, and, according to Florus, also from the Scythians, Sarmatians, and even the Seres, to court the friendship of Augustus, who was then in Spain. Those from India were nearly four years upon their journey. Augustus was called the father of the Roman imperial navy, of which Ravenna on the Adriatic was the principal eastern station, and Misenum in the gulf of Naples, the western. Pliny says, in his reign some Roman navigators explored the coast of the North Sea as far as Cimbri (the north end of Denmark). At this time the Britons used small vessels of which the keel and principal frame was made of light wood, the bottom and sides of a kind of basket work made of osiers, and the whole was covered with hides.

The Arabians, who furnished the greatest and most reliable part of articles imported into the Mediterranean, appear to have been the only traders from the West, whose voyages in very early days extended to India. In 1851, I met a small native Arabian vessel far from land in the Bay of Bengal, bound towards the Spice Islands of the Malay Archipelago—a notable relic of ancient times. People of such commercial and nautical knowledge as the South Arabians, could not have experienced the semi-annual changes of the monsoon, without early availing themselves of the advantages they offered to their navigation. It would by no means be extravagant to suppose that they traded to Taprobanè (Ceylon), or even to countries and islands far beyond it. As early as the days of Solomon (B. C. 1000), no such spices were known in Jerusalem as those presented by the Queen of Sheba; and later we learn in the days Ptolemy Philadelphus, B. C. 280, the Sabæans, whose long experience in the nature of the periodical winds called monsoons, of the seas and various ports of India, undersold the merchants of Egypt, who coasted the whole way to India in their own small vessels. Ptolemy sent Dionysius to India as Ambassador, with a view of establishing direct intercourse with that country.

In the "Periplus* of the Erythræan Sea," oriental vessels then in use are thus described: *madaratæ*, small vessels joined together by sewing; *trappaga* and *kotymba*, long vessels used by fishermen and pilots; *sangara*, piratical crafts like double canoes; and *kolandiophonta*, which vessels were of the largest size, with capacity to perform distant voyages, and were in the trade of Arabia, with the river Ganges, and countries beyond it. This work which, for approved accuracy of geographical, nautical and commercial information, stands unrivalled by any production of antiquity, comprehends under the name of the Erythræan Sea, all the ocean between Africa and

*The PERIPLUS (circumnavigation) was written about the first century of the Christian era by an Egyptian Greek, an intelligent merchant and practical navigator upon the Erythræan Sea.

India, including the Bay of Bengal. It observes that the unexplored ocean extends to the southward until it joins the Atlantic, information generally concealed from the age of Necos, B. C. 616, until the re-discovery of the Cape of Good Hope by the Portuguese in the fifteenth century.

Some authors say that Solomon's ships circumnavigated Africa and returned by the Mediterranean laden with gold. More likely they availed of the monsoons and went to Ceylon, India and Sumatra.

The Seres, described as the most remote people of Asia known even by report to the Europeans, are said to have manufactured sericum or silk garments from threads finer than those of the spider, which they combed from (cocoons like) flowers. Nearchus, the admiral of Alexander's fleet, speaks of this precious manufacture which found its way to Rome in the days of Cæsar, and being a monopoly and subject to a long succession of tedious and dangerous sea and land carriages, sold at a price making it equal in value to gold. Seres also shipped to Arabia steel much superior to all other kinds, the product of a country in the eastern part of Asia. White rock candy and porcelain such as is produced in China, was also shipped, and all these bore the expense of a succession of land and water carriages. May not the steel have come from Japan and the porcelain from China? When the Portuguese arrived on the coast of Asia in their first voyages of discovery, they found it frequented by vessels of various nations.

The natives of India, deriving all the necessities and enjoyments of life from their fertile soil and own industry, cared very little for productions of the West. Grecian merchants were obliged to pay for their cargoes chiefly in money, and Pliny says, that at the lowest computation, 500 sestertia (equal to £403,645 16s 8d sterling) was every year sent out of the Roman empire for the purchase of goods, which were sold in Rome at an advance of one hundred for one. A sum equally large was also paid to Arabian merchants for articles from their country of mere luxury and female vanity.

The increasing demand of almost the entire Roman empire for Oriental luxuries, all of which when crossing Egypt in transitu paid especially heavy import and export duties, increased the revenue of that country immensely; some idea of which is given us by Appian, who says Ptolemy Philadelphus at his death, left in his treasury 740,000 talents, (equal to £191,167,666 13s 4d sterling), much of which, however, may have been derived from the plunder looted by his father from the Persian empire.

In thus glancing at the early records of ocean navigation among the Arabians, Phœnicians, Greeks, Hebrews, etc., we discover the important position occupied by the Phœnicians, as the principal supporters of an early and extended intercourse with the Orient. We may draw some analogies therefrom in a future outline of the early commerce of Asiatic nations, among themselves, and their intercourse with the American continent in very early times. All these movements of peoples have an important ethnological bearing, as revealing the possible methods of migrations along the shore-lines of countries.

From early maritime records here cited in illustration, we are led to infer that intercommunication by water, along coast-lines, was very ancient among all western nations at a very early period, and we are persuaded that all

commerce was then in connected circles, like links of a chain; each orbit of trading fleets communicating at its extremes with others farther east and west. Thus the silk of China and Japan, unknown in Europe, found its way into ports on the Baltic Sea, through several limited districts of trade, each keeping within its natural limits, but acting as a medium for circulating the products of one extreme to the other. All trade being more or less a monopoly, the point of production of many valuable commodities was frequently concealed.

Certain terminal points exist in all trade where one system of commerce links into and connects with another reaching beyond. Such were Gadir, Massilia, Alexandria, Tyre, Sidon, Taprobanè (Ceylon), Molucca, Seres, etc.

Thus legends and traditions of far distant countries were communicated in advance of their discovery, and although at first deemed mythical, were generally founded on facts, and largely confirmed by later discoveries and explorations in the field, and since found fully detailed in Oriental histories yet extant. Every variety of enormity has in all ages been the characteristic ascribed by ignorance to unknown nations, and these have been gradually removed farther and farther as discovery advanced.

Great numbers of people were distributed by this early commercial enterprise, and how large indeed must have been the number of ancient Phœnician and Malay wrecks, if the Japanese wrecks of the present day may be accepted as any criterion. Nature is universally consistent.

In future papers I shall discuss the different origin of the Chinese and Japanese races, and conclude by expressing the opinion that early races have been far more spread and intermixed by early maritime intercourse, than the casual observer would suppose, and that, however distinct any type of mankind may appear, all will be found to be more or less composite, excepting, perhaps, some remnant of early aborigines, driven into a forced seclusion among the fastnesses of interior mountain ranges.

The authorities adduced in this paper might be greatly increased, but I have studied to be as brief as possible, aiming only to show the progressive quality and universality of natural law, whereby analogical reasoning is rendered comparatively safe, and to *establish the fact of early intercourse* among maritime nations of the West, rather than to fully illustrate either, by elaborate details.

Dr. Brigham read an invitation to attend the International Congress of Americanists, to be held at Nancy, France, July 22, 1875.

Judge Hastings called the attention of the Academy to the fact that the work of the State Geological Survey on the "Botany of California" would shortly be published. As the flora of the Pacific Coast develops some characteristic species, novel and interesting, worthy the attention of the students of this science, it is highly to be desired that the work on the botany of this State should be published. This publication is now secured

through the exertions of D. C. Gilman, President of the University of California, at whose request the following named gentlemen have contributed the necessary funds to put the work in stereotype: Leland Stanford, Henry Pierce, R. B. Woodward, Lloyd Tevis, D. O. Mills, J. C. Flood, John O. Earl, Wm Norris and Chas. McLaughlin. These gentlemen are not known to be scientists, and do not appear to be actuated by any special or personal motive. The California Academy of Sciences, therefore, in recognition of their generosity, orders that their names be enrolled upon the records of the Society as benefactors of Science.

And it is deemed proper that honorable mention should be made of Professor Asa Gray, Professor J. D. Whitney, Professor Watson and Professor W. H. Brewer, for their personal devotion to the work without pecuniary consideration.

The Secretary was ordered to incorporate the above remarks in the minutes.

REGULAR MEETING, APRIL 5TH, 1875.

Vice-President Edwards in the chair.

Sixty-five members present.

Donations to the Cabinet: From Chas. D. Gibbes, bird's nests from San Joaquin County; from Mr. Frink, collection of grasses, bark and nuts from Hawaiian Islands; from Professor George Davidson, a collection of Japanese plants.

Horatio Stone read a paper on the Unity of Arts.

Amos Bowman read a paper on Coal Deposits of the Pacific Coast.

Professor Brewer exhibited a map showing the distribution of woodlands in the United States. In speaking of the map he alluded to the theory of the connection of the existence of forests with rainfall. In the investigations of the Smithsonian Institution, no instrumental evidence had been found, in any part of the United States, that the destruction of forests had re-

duced the rainfall. The fact appears to be so, but has not been properly proven.

Dr. Gibbons did not agree with Professor Brewer, and thought there was evidence to prove that there was a connection between the existence or non-existence of forests and rainfall. In California, in regions very limited in extent, the rainfall varies greatly in a few miles, the greater amount falling in the vicinity of timber.

Dr. Gibbons exhibited a branch of poplar tree on which a piece of misletoe had grown in a peculiar manner. It came out from the end of the broken branch as if it had been grafted.

Regular Meeting, April 19th, 1875.

In the absence of the President and Vice-Presidents, John Hewston, Jr., was called to the Chair.

Fifty members present.

The following new members were elected: Alfred E. Regensberger, Jas. B. Clifford, E. T. Tarbox, Arthur C. Taylor, Chas. Frances, J. R. Stanton and F. P. Hartney.

Messrs. S. B. Christy and Frank Soulé were proposed for membership.

Donations to the Museum: From Professor Gustaf Eisen, University of Upsala, Sweden, two specimens of *Pinus flexilis* in foliage, two cones and foliage of the sub-alpine form from Mono Pass, former 12,000 feet, latter lower; also *Ephedra antisyphalitica* and *Abies Pattoniana* (Williamsonii) from same locality. W. G. Blunt donated silky poppies of an unknown plant used in stuffing birds; Joseph H. Clarke, of Cahto, Mendocino County, California, presented specimens of salmon trout. From T. J. Butler, Arizona, specimen of curious insect captured in Agua Fria River, Arizona.

Professor W. H. Brewer read the following:

On the Formation of Ice-pellets or Hail, in the Spray of Yosemite Fall.

BY PROFESSOR W. H. BREWER.

On Wednesday last, April 19th, in company with Mr. Galen Clark (under the Commissioners, custodian of Yosemite Valley), I visited the foot of the upper Yosemite Fall. In the winter, a great *ice-cone* forms in front of this fall, mostly, it is probable, an accumulation of frozen spray. It is now much reduced by thawing from what it was a month ago. At our visit, it extended below the fall several hundred feet, bridging the chasm to an unknown thickness. The two persons most familiar with it, respectively estimated its thickness that day at "sixty to one hundred feet," and "nearer two hundred feet." The outer side of this "cone" slopes away from the fall; the inner side rises like a wall in front of the sheet, which falls mostly behind it with deep, thunderous sound; the water flows beneath the mass, and emerges from an icy arch at its foot, which arch in shape and appearance strongly reminds one of the ice-arch in the foot of the glacier at the source of the Arveiron, at Mt. Blanc.

The stream was so high from the melting of the snow, that it dropped from the extreme top, not clinging to the rounded crest, as it does when the water is lower, but leaping out so that the actual leap is perhaps fully 1550 feet to the rocky bottom, and to the top of the "ice-cone," nearly or quite 1500 feet. Over the ice-cone the spray is furiously driven by the powerful air-blast produced by the fall.

The day was warm and clear, the time of observation between 12 M. and 12.30 P.M., and the fall in its brightest illumination, as it faces nearly south. As we neared the ice-cone, certain appearances suggested to me that the spray which drifted over it was (in part, at least) snow. To examine this, we ventured on this cone farther than strict prudence dictated, and in the tempest, which stung our hands and faces like shot, we found the spray in part to be *hail*, or *ice-pellets*. The exact character of these pellets could not be studied in the blinding blast to which we were subjected. They appeared to be hard, like hail-stones, tolerably uniform in size, and I estimated them at about one-tenth of an inch in diameter. They accumulated quite copiously on our clothes, but most so towards our feet, as if they were most abundantly hurled along near the ice on which we stood. They also accumulated in thin sheets on the rocks which rose through the ice near its edge.

The ice-cone, which had been very white during the winter, had been sullied by sand and dirt carried over it with the spray in the heavy storm of the previous week. Near its lower edge, however, were many depressions filled with what appeared to be new and pure snow, which we believed to be in reality fresh accumulations of these ice-pellets, but from their position it was impossible to examine them. We however pushed our way back to the rocky

wall beside the fall and as near the sheet as it was possible to breathe or to stand. If any of the pellets occurred there, I could not prove it. I could not feel them, and the water so blinded us that nothing could be seen distinctly. On returning, we kept on the rocks, and noticed none of the ice-pellets there. I had left my thermometer behind, and had no means of testing the temperature of this freezing blast.

At Leidig's Hotel, which is one and three-eighths mile distant and about a thousand feet lower, my thermometer stood at about 52° Fahr. at 6 A.M.; 78½° at 2.30 P.M.; 79° at 3.15. P.M.; 58° at 9 P.M., and 50° at 6 the next morning. I had no *wet-bulb* to determine the dryness, but that the air was very dry was shown by the rapidity with which our saturated clothes dried.

When this fall was visited by the State Geological Survey in June, 1863, the idea was suggested that we examine the temperature of the water above and below the fall, to see if any actual heating of the water occurred as a result of its concussion after falling from so vast a height. The dryness of the air was then so great that I was convinced that evaporation would counterbalance or at least vitiate any results that might be theoretically based on the mechanical equivalent of heat, so the experiment (which would have cost much labor and time) was not tried. And on seeing this new phenomenon, the hypothesis which immediately suggested itself to me as an explanation was that it was due to evaporation. That the fall is fed by melting snow, much of which still lies near its top; that the great volume of ice-cold water chills the adjacent air to near 32 degrees; that the air-current thus cooled, as it is drawn into and along with the immense descending mass, is a very *dry* current, and that its rapid saturation by this evaporation of a portion of the spray is sufficiently chilling to freeze drops of water up to a certain diameter. Had the ice-pellets been portions of the ice-cone torn off from its edge and hurled outward with its spray, we would not expect such an uniformity of size as I observed.

Professor John LeConte, on my describing the phenomenon to him to-day, has suggested another hypothesis, more plausible, perhaps, than mine. It is that the air carried down and cooled by the water is somewhat condensed at the base of the fall, and that by its expansion as it gets away from the pressure, sufficient cold is produced to freeze the drops.

Whatever may be the explanation, of the *fact* there is no mistake.

T. J. Lowry read the following paper:

Hydrographic Surveying.

BY T. J. LOWRY, U. S. COAST SURVEY.

Hydrographic surveys of bays, lakes, rivers, gulfs and the parts of oceans adjacent to coasts, are indispensable requisites to a safe navigation, and hence successful international commerce. Being of national importance, they are therefore national undertakings—and the Government Coast Surveys and

navies of all countries are engaged in determining and mapping the topography of the water basins and channels of the earth.

An accurate survey of waters adjacent to land is based upon a survey of the adjoining lands, by means of which the figure of the coast and the positions of a sufficient number of conspicuous and well-defined objects near the coast have been ascertained. These objects are the landmarks, by observations of which the positions of points on the surface of the water (and hence the soundings) are determined. The relative positions of the landmarks are ascertained with a degree of accuracy proportionate to the character and extent of information to be given by the chart. When perfect accuracy is aimed at, many stations on shore (and especially on island shoals and reefs) are first determined usually by a trigonometrical survey whose accuracy is tested by a base of verification. The stations in the triangulation being selected with reference to the ultimate ends in view (viz., the wants of the hydrographer and navigator), will be so chosen as to include or determine light-houses, headlands, and other remarkable objects—not allowing the triangles, however, to depart too much from the well conditioned forms. In making choice of stations, and thus giving shapes to the triangles, it is well to remember, that where *all the angles are to be observed*, the condition most favorable to the accuracy of computation—i. e., where instrumental errors and errors of observation will least affect the determination—is where each triangle is equilateral. But where *two angles only are to be observed*, the unobserved angle should be a right angle, and the observed angles equal to each other and never less than twenty-five or thirty degrees. Experience proves that, in well conditioned triangles, the small errors made in the measurement of the angles do not accumulate through each successive step in the operation, but on the whole tend to compensate each other.

Whatever extent of coast may be surveyed, each series of hydrographic operations will be confined to comparatively limited spaces, and the whole will consist of numerous detailed charts correctly linked together and harmonized by means of the triangulation on shore; a description, therefore, of the *modus operandi* in making a hydrographic survey of a single harbor or short sea reach will apply equally to the system adopted in the survey of an extensive line of coast.

Having made a reconnaissance of the region to be surveyed, and gathered a general idea of the facilities for, as well as the difficulties of doing the work, the next step is to locate tide gauges and tide observers.

Judging from all information that can be gathered of the prevailing winds, currents, tides, shoals, and the configuration of the shore line, the hydrographer will fix the number and sites of his tide gauges so as to get data for determining the figure of the surface of the water at any given instant. They should be more numerous the more the surface of the water at any instant deviates from the horizontal form. And the fewer the gauges used the greater the care to be exercised in deciding upon their locations. Placing a gauge within a bar, sand-bank or other impediment to the free action of the water, or within a lagoon which winds fill with water faster than it can escape, is to be especially guarded against. And in comparatively limited basins of water

at least two gauges should be established—one at that side of the basin nearest "whence the prevailing winds come," and the other nearest "whither they go." These gauges are not only checks on each other when the wind's action is an insignificant element, but where the wind drives water from one portion of the basin and piles it up in another, they furnish data indispensable for harmonizing soundings taken on those and calmer days.

In such a basin, when but one gauge is used, the proper place for it, theorectically speaking, is the center of the basin. These considerations attended to, each gauge is firmly fixed in a well sheltered spot, so that its zero shall be below low-water at neap, and its top above high-water at spring-tides. By proper circumspection for the site of each gauge, one will generally be found to answer for each station, but where the observation is made from shore two or more may at times become necessary—the observer following the tide from gauge to gauge as it goes out and retreating over the same path as it comes in. The kinds of tide gauges are as various as the circumstances demanding them. The one ordinarily used is of the simplest kind, a straight vertical post divided into feet and tenths, numbered from the bottom upwards; this is found generally to serve its purpose, inasmuch as when it is too windy to read the gauge correctly, it is blowing too much to sound accurately. A vertical tube with small holes at the bottom to admit the water which supports a float, is, however, susceptible of closer readings under all circumstances; and for getting off-shore tides, Mitchell's gauge is admirably adapted; while as a self-registering gauge, Saxton's stands without a parallel and leaves nothing to be desired.

The zero of each gauge should be referred by means of a spirit-level, or otherwise, to a bench mark cut distinctly and durably on some permanent object (and the remark made in the book), so that, if displaced, it can be properly replaced in position.

For the purpose of reducing the soundings, it is mainly essential that the tide-gauge and sounding-boat watches be together; but where the laws of the tides of the locality are also desired, it is best to keep either lunar or mean solar time. A series of observations of the tides on these gauges, made simultaneously with the soundings, furnish data for reducing each sounding to the reference plane—the mean of the lowest *low* waters. This plane is also given by these tidal observations. The frequency of the necessary readings of the gauge varies from every half-hour to every five minutes, according to the rapidity of the rise and fall of the tide.

And now, if there be not on the shore permanent well defined objects that will serve as signals—such as spires, towers, flagstaffs, light-houses, or tall slender trees, fixed by triangulation—then the hydrographer erects the necessary signals; usually tripods boarded up, and painted white if projected on dark back-ground from the sounding-boat, or red (or black) if against the sky or a sandy back-ground.

The tide-gauges and signals being erected, the next step is to determine carefully with a theodolite the relative position of these signals, and plot them by the computed sides of the triangles of which they are the vertices. It is, however, not imperative that the actual sizes of the triangles be at first

known; but the triangles can be computed and plotted from any assumed base, since the "relative positions of the signals" is the essential desideratum.

Hydrographic surveys all have for their main object the tracing, determining, and plotting, on a suitable scale, the contour lines of navigable channels and water-basins. Contouring represents the inequalities of the earth's surface by determining the relative heights of any number of points above or below a line equidistant at every point from the earth's center. This line is what is understood by the term "a level-line," and is that which is assumed by the surface of the water when at rest. In mapping the contours of parts of the earth not covered with water, after the principal contour lines are drawn on the topographical sheet, intermediate lines may, with the ground before the eye, be sketched in; but such interpolations are obviously impossible when tracing the contour lines of a basin filled with water, as in hydrography, where a series of points in the curves of equal depths are brought out only by lines of levels made with the sounding-line. Now, since these lines of equal depths are analogous to contour lines on land—being contour-lines of the bottom of the water-basin, drawn through those points where the reduced soundings are equal—the same rule hence obtains in hydrography as in topography for the directions of the lines of levels for developing them—viz., perpendicular and parallel to the strike or dip of the bottom, i. e., one system of sounding-lines coincident with, and another at right angles to the lines of the steepest declivity of the bottom. The lines run in the general directions of the curves of equal depths, or horizontal curves, are the main lines in developing the contours of the bottom; yet the auxiliary lines which should be run perpendicular to these not only check these depths, but also furnish additional data for drawing these curves of equal depths. At a crossing of these lines the difference of the soundings should not be more than three per cent., and the limit of error must not exceed five per cent. of the depth.

To form some idea of the general configuration of the bottom of a body of water, we must call in every available aid; as, the topography and geology of the adjacent coast, the effects of currents, tides, and prevailing winds, and, most of all, the revelations of our lead-line, which assist us in judging of the topography of the parts yet unsounded, and hence better fix upon the directions of the lines to be run. The force and directions of winds and currents and qualities of the vessel must of course be considered in laying out directions of sounding-lines. And the greater discretion exercised in giving directions to these lines the fewer in number will it require to bring out the bottom's varied features in the length and breadth of their modulation. The number of lines required depends upon the extent of the information to be furnished by the chart.

If for purposes of general navigation, the soundings on the map will be sufficiently numerous when the horizontal curves (viz., fathom and half fathom, up to three fathoms, and inside of that, feet curves) can be drawn without doubt as to their directions in any case. As to the frequency of the casts, where the bottom is very irregular, are wanted not casts at studiedly regular intervals, but every possible sounding.

Whether it is the demands of the navigator or the marine engineer that are being satisfied, along with these contour lines of the bottom are required the materials of which the bottom consists, the level, rise and fall of the water, the directions and speeds of its currents, and at times, the temperatures and specific gravities of the water. The accuracy of the methods and instruments for executing these surveys also varies with the amount of detailed information required. If the survey be made for the erection of a breakwater, instead of purposes of general navigation, then are desired nicer instruments for observations, more well-determined signals, more cast positions determined, more soundings on a line and more lines of soundings, more specimens of bottom and more current observations. In every case, however, the whole ground should be gone over thoroughly to bring out the general features of the bottom and detect each sudden irregularity of depth, which should be traced through its every line of approach, and if it proves to be an isolated knoll or ridge, it may be "rayed off" by planting one or more temporary buoys on it, and to and from them running radii in different directions. However, as these radial lines are often insufficient to bring out its every feature, others may be run at right angles to them. Yet for general purposes of navigation the general features and extent of a reef and the shoalest cast on it are found amply sufficient. As each sounding is taken, the surveyor notes its depth and also the time which fixes its position with reference to other points on the line determined by either sextant, theodolite or compass angles on known fixed points.

The degree of precision with which the positions of the sounding-boat are fixed determines the accuracy, and hence usefulness, of a hydrographic survey. To fix the position of the sounding-boat, under every variety of circumstances, is, therefore, the all-important problem in practical hydrography, and the method most universally relied upon by the hydrographer for determining his boat's position, is that by the three-point problem.

This problem is wide in its application, accurate in its determinations, and most simple in its graphic solutions. The simultaneous observation of the two angles subtended by three signals fix the place of observation under every possible contingency—except when it is on the circle passing through these three signals—i. e., when the three circles of position are coincident. The accuracy of the determination of positions by this problem depends mainly upon the relative positions of the signals and the observer, and the size of the observed angles—being the very best where the signals are equidistant from the observer, and subtending angles of 120 degrees. The three signals in a straight line, is a favorite location with many hydrographers, as it offers but one case of indetermination, and that very easily avoided, of being on the straight line passing through them. But in general a most desirable location is where the circle through the three signals is convex towards the observer, and the middle one is the nearest of the signals, for then "a revolver" is impossible. Other things being equal, it is better to "angle on" the more distant objects which subtend good-sized angles—say from 45 to 135 degrees—for not only is the parallax of the sextant then less, but an error

made in getting an exact coincidence of the images of the signals is then less felt by the angles than if the signals were near or the angles very acute.

And besides what is thus told by the relative positious of the signals, the hydrographer should be able to read the tale which the size of the observed angles tell of a position's fixedness. If the sum of the observed angles equals 180 degrees or more, then the observer is sure he is not on the circle of indetermination. But if this sum is less than 180 degrees, and equal, or nearly so, to the supplement of the angle subtended at the middle signal by the other two, then the position is not determined. By having these supplements written about the signals, between the proper lines, on the field-sheet, we can by a mental summing of the observed angles tell (without plotting) whether we are too near the circle to get a good determination; and may thus catch other angles that better fix our position.

The three-point problem finds in the three-arm circular protractor an accurate, simple and most expeditious graphic solution, which is most extensively used in plotting positions of the sounding-boat. In practice the observed angles are set off on the proper lines of the protractor, and the fiducial edges of its arms caused to traverse the three points representing the signals observed upon, and the center dotted, and the position is plotted. If breakers denoting danger be observed at a time when it is impossible to anchor over them, or even approach them to fix a buoy to mark their locality, their position may be marked quite accurately by pulling around them and getting cross ranges (or cross magnetic bearings) of prominent objects on shore, so disposed as to guide the observer to the spot in more favorable weather, when a perfect calm may leave no trace whereby the danger can be recognized.

Henry Edwards submitted the following:

Pacific Coast Lepidoptera, No. 11.—List of the Sphingidæ of California and Adjacent Districts, with Descriptions of New Species.

BY HENRY EDWARDS.

As the value of local lists is fully recognized by entomologists, I propose, in the present paper, to furnish a complete catalogue of the species of this interesting group of Lepidoptera, as far as known to me to inhabit the Pacific Coast, and to offer descriptions of what appear to me to be forms as yet unrecognized by science. The number of species, compared with those of the Eastern States, is but small, but extended exploration of our little known mountains and valleys may furnish us with others, while it is more than probable that many of those from Northern Mexico may yet be found within our borders; and, acting upon this belief, I have introduced the description of an exquisite species from the region of the Sierra Madre, which may some day have to be included in our lists. I have followed the arrangement proposed by Messrs. Grote and Robinson in their catalogue of Lepidoptera, (No. 1, Am. Entom. Soc., 1868,) and have invariably adopted the generic

terms of those authors. The notices of the habits and localities of the species are from my own observation, and for them I am personally responsible.

Tribe MACROGLOSSINI.

Arctonotus lucidus. Bdv.

Head, palpi, antennæ, thorax, and abdomen, yellowish olive. Thorax, with the tegulæ a little darker, and edged narrowly with white. Abdomen, with small anal tuft. Anterior wings, yellowish olive, with a darker median band, not reaching the interior margin, and surrounded by an oblique rich purple border along the interior margin, and obsolete before reaching the costa. This border has a rather brilliant metallic reflection. Beyond the middle is a notched shade of olive, resting on the costa, a small linear patch near the apex, and a lunate streak near the interior angle, of the same color. Fringe of the exterior margin, yellowish, with the edges brown; that of the internal margin, purplish, concolorous with the oblique band. Posterior wings, reddish fawn color at the base, with a rich claret-red submarginal band, narrowing inwardly, and lost in the brown hairs of the anal angle. Margin, broadly reddish fawn color, the same shade as the base of the wings. Under side, grayish olive, with a ferruginous patch on disc of the anterior wings. Fringes, deep fawn color. Middle tibiæ, with four black, shining, palmated spines, recalling somewhat the structure of the fore tarsi of *Gryllotalpa.* Hind pair, with two spines, fawn color, clothed with hair.

Expanse of wings, 2.00 inch.

Length of body, 1.00 inch.

Coll. Dr. Behr, Sacramento. H. E., Oregon.

I have taken the liberty to redescribe this very rare Sphinx, as Dr. Boisduval's description is both brief and vague, and as I have had the good fortune, recently, to examine six specimens of this little known insect, which were forwarded to me from the Dalles, Oregon, for the most part in excellent condition. At present, this is certainly one of the rarest species known to American entomologists. I have followed Mr. Grote in placing this genus in the present group, though not without misgivings, as its general structure, particularly the form of its antennæ, its long body clothing, and its extremely short tongue, seem, as Clemens observes, to point out its proximity to the *Bombycidæ.* It has been placed by this author, and by Walker, at the extreme end of the *Sphingidæ.*

Hemaris Thetis. Bdv.

Through the kindness of my friend, Mr. Grote, I have recently had the opportunity of examining Boisduval's type specimens of this species, the former gentleman's admirable description (Trans. Am. Ent. Soc., Vol. 1, 1868) rendering further notice of it unnecessary. I should, however, observe, that in fresh specimens there is always present on the hind tibiæ a bunch of long, pale yellow hairs, which are not visible in the somewhat worn and faded type specimens. The presence of the reddish apical spot in the anterior wings is, I think, by no means a safe character, as in any one of my specimens it is

quite apparent, while in two others it is entirely absent. This species may, however, be always known by the thoracic and abdominal clothing, which is invariably dull olivaceous, with a brownish tinge, and is extended without any break to the yellow pre-anal segments. *H. Thetis* is found in the valleys of California, chiefly in the neighborhood of the Coast Range, and may be sought for, in May and June, in Napa, Sonoma, and Marin Counties. It is especially attached to the flowers of various species of *Lupinus*.

Coll. H. E., (exactly agreeing with Boisduval's type) Dr. Behr, *et al.*

Hemaris rubens, n. sp. (?) Hy. Edw.

Under this name, if a true species, I wish to recognize two specimens, in my collection, in which the apical red mark is very distinct above and below, the oblique scale patch at the base of the primaries reddish, and the costa and margins of the wings on the lower side also with a decided reddish hue. In *H. Thetis*, the two pre-anal segments alone are yellowish, but in the two specimens referred to above, the yellow is carried on to the third segment, dorsally and beneath, but is interrupted on the sides by a black band. This appears to me to be a strong character, as in my examples of *Thetis* the yellow shade is distinctly confined to the two pre-anal segments. Slightly smaller than *Thetis*. The tuft of yellow hairs on the hind tibiæ is present in this species.

Oregon, Lord Walsingham. Lake Tahoe, Cal., Mrs. Hy. Edwards. Coll. H. E.

Hemaris cynoglossum, n. sp. Hy. Edw.

Size of *H. Thetis*. Head above, pale yellowish olive; eyes, margined behind with white scales. Palpi, pale yellowish, with the terminal joint tipped with black. Thorax above, bright greenish olive, without the brown tint observable in *Thetis*. Basal segments of abdomen, rich velvety black. Two pre-anal segments, pale yellowish, with a darker median shade. The under side of abdomen, including the anal tuft, is wholly black, except the edges of the pre-anal segments, which are pale lemon yellow. The thorax is less covered beneath with yellowish hairs than in *Thetis*, and the pale scales are hardly visible at the base of the wings, while the tufts of yellow hairs on the tibiæ, so eminently characteristic of *Thetis*, are here wholly wanting. The wings above and below are similar to the allied species, but are decidedly more opalescent, giving out a most beautiful bluish reflection. Antennæ, blue black. The fore wings are a little sharper at the apex than those of *Thetis*.

Two ♂, two ♀, Coll. Hy. Edw., taken by myself on flowers of *Cynoglossum grande*, Dougl.; Napa County; Big Trees, Calaveras County, Cal.; Vancouver Island.

The species of the genus *Hemaris* are very closely allied, and can be separated only by characters which in other genera would hardly be deemed sufficient to indicate a difference of species. I think, however, that the absence of colored hairs on the basal segments of the abdomen, and of the pencils of yellow hairs on the hind tibiæ, will serve as good grounds for

separating this form from its allies. The differences between them are very apparent in a series of each.

Hemaris palpalis. Grote.

Taken at Gilroy, Santa Clara County, by the late G. R. Crotch. Its chief difference from *Thetis* seems to be in the darker shade of the labial palpi.

It is somewhat remarkable that no species of Mr. Grote's genus *Hæmorrhagia* has yet been discovered on the Pacific Coast, more especially as in the Atlantic States the species are more numerous than those of *Hemaris*.

Ællopos tantalus. Hubner.

This fine insect is not rare in the neighborhood of Mazatlan and other portions of Northern Mexico, and I have seen a specimen taken at Cape St. Lucas, Lower California. It may, therefore, yet be found within our limits.

Euproserpinus Phaeton. G. & R.
=*Macroglossa Erato.* Bois.

This exquisite little species, so rare at present in collections, appears to be found only in the vicinity of Los Angeles, two specimens in the collection of Dr. Behr and the original types in that of Dr. Boisduval having been obtained from that locality. It is said to be an early insect, and probably disappears with the flowers of the spring.

Proserpinus Clarkiæ. Bois.

As the delicate green tint of this beautiful insect fades very quickly, I subjoin the following description from a very fresh specimen, taken during the past summer, in which the original color is at present admirably preserved. It will be seen that both Clemens' and Boisduval's descriptions give a wrong idea of the color of the insect.

Head, greenish olive above, whitish beneath; labial palpi, whitish, with green tinge. Eyes and tongue, brownish black. Antennæ, black above, reddish beneath; terminal spinule, white, with the extreme hook yellowish brown. Thorax above, greenish olive, whiter at the sides and beneath. Abdomen, greenish olive with a white tinge, except the three anal and the fifth segments, which are dark olive green, the anal segment being marked in the center with a paler streak. Beneath, the abdomen is greenish olive, with the segments edged posteriorly with white. Anterior wings, rich greenish olive, the color of *P. Ænotheræ*, paler at their base, except towards the costa, where there is a darker shade. "The median space is rich greenish olive, narrowing to the internal margin, and enclosing a black discal streak." Behind this band, and resting on the internal margin, is a pinkish shade, not visible in old specimens, and beyond this is a rich olivaceous band, spreading to and widening out upon the costa, the outer edge being somewhat notched. Fringe of the anterior wings, olive green, tipped with black Posterior wings, bright orange yellow, with a broad and moderately regular black marginal band. Fringes, yellowish white. Under side of wings, wholly olivaceous green, darkest at the base. Across the disc of the posteriors is a slightly waved

whitish band. The discal streak of the anteriors is scarcely visible. Feet and legs, whitish green.

Not rare in the northern portion of California and southern Oregon. A number of specimens were taken by Lord Walsingham, near Fort Klamath, and it occurs not unfrequently, in May and June, throughout the Coast Range and the Sierra Nevada. It appears to delight in the flowers of the various species of *Gilia*. Dr. Boisduval says that his specimen was raised from the caterpillar by the late Mr. Lorquin. It is a matter of regret that we possess no record of its earlier stages.

This is undoubtedly the species referred to by Mr. Grote in Bull. Buffalo N. H. Soc., 1874, as *Lepisesia Victoriæ*, the description having been evidently drawn up from a somewhat faded specimen.

Proserpinus Terlooii, n. sp. Hy. Edwards.

Head and palpi, yellowish olive. Eyes, black. Antennæ, dark olive; pectinations, brown; hooked tip, white. Thorax and abdomen, yellowish olive, the former with some darker shading in front. Anterior wings, yellow olive, greener towards their outer margins, with a median band of olive green, widest on the costa, and a triangular patch, a little paler than the band, resting on the costa near the apex. Fringe, mottled with brown. Posterior wings, dull claret red, paler along the costa, and shading into deep rich brown on the posterior margin.

Under side. Anterior wings, yellow olive, with a wide central shade of dull red, reaching from the base to within three lines of the margin, but not touching the costa. Posterior wings, yellow olive, with indistinct waved median band of a little darker color.

Expanse of wings, 1.65 inch.

Length of body, 0.70 inch.

Two ♂ Coll. Dr. Behr, taken near Mazatlan, Mexico, by the late Baron Terloo, to whom, at Dr. Behr's request, I dedicate this interesting species.

Tribe CHÆROCAMPINI.

Chærocampa procne. Clemens.

I can learn nothing whatever of this insect, and think some error must have occurred as to its locality. Is it known that the type specimen is in existence, and, if so, where?

Deilephila chamænerii. Harris.

This species, which I am disposed to regard as different from *Galii* of Europe, is not uncommon in Vancouver Island, and has been occasionally taken in Oregon and Northern California. It would satisfy many entomologists if a long series of this insect could be raised from the caterpillar, through a succession of years, as by these means alone can we arrive at a certain conclusion as to its value as a species. It seems to me to be a much heavier and more clumsy-looking insect than *Galii*, and its general color is considerably

darker. But it appears somewhat absurd to claim for this the rank of a species, and deny the same position to its congener, which follows, as between *Daucus* and *Livornica* more really serious differences exist than between *Chamœnerii* and *Galii.*

Deilephila Daucus. Cramer.

This is perhaps the most common of all the *Sphingidœ* of the Pacific Coast, being found from May to August in almost every garden, hovering about flowers, especially those of *Verbena.* The caterpillar, though well known, has never, to my belief, been described or figured. It feeds on various species of *Rumex, Epilobium* and *Polygonum.* The additional white stripes upon the thorax certainly give this a wide separation from *Livornica* of Europe, while there is considerable difference in the shape of the median oblique band of the anterior wings. In a specimen of *Livornica* from Italy, and also in one from the White Nile (both in my collection), this line is broader than in the American specimens, and, as it reaches the internal margin, spreads inwardly further towards the base of the wing. The costal markings also are more decided in the European and African specimens, and the marginal band of the posterior wings is certainly much narrower.

Philampelus Linnei. G. & R.

A fine specimen of this very handsome species exists in Dr. Behr's collection. It was taken by the late Baron Terloo in the northern part of Sonora, Mexico, at the base of the Sierra Madre.

Philampelus Achemon. Harris.

Very common, in some seasons, in the valleys of Napa and Sonoma Counties, where the caterpillar is exceedingly injurious to the vines. In the summer of 1874, at St. Helena, Napa County, over ten bushels of caterpillars were gathered from one vineyard, only four acres in extent, in the course of two days. I can perceive no difference whatever between the California specimens and those from the Eastern States.

Tribe SMERINTHINI.

Smerinthus ophthalmicus. Bdv.

Formerly rather common in the vicinity of San Francisco, but owing to the drainage of large districts, and the consequent destruction of the willows on which the caterpillars fed, it has become quite a rare species. In the foothills of the Sierras and the Coast Range, as well as in Oregon and Vancouver Island, it is occasionally met with, and a strongly marked variety is also found, which I have called

Smerinthus pallidulus, var. Hy. Edw.

It differs from the typical form by its much paler color, as well as by the almost obsolete markings of the upper wings. The general color of these is a

pale fawn drab, with the waved band indistinct. The thorax is also much paler, and the median patch of this portion much narrower and less defined.

Mr. Strecker's figure of the ♀ in Lepid. Rhop. et Heter. refers to this variety.

Smerinthus modestus. Harris.

Another very remarkable instance of departure from the specific type is found in our examples of this species, all of which are very large in size, the smallest I have seen being upwards of five inches in the expanse of wing, the specimens from the Atlantic States rarely measuring as much as four inches. There is also a remarkable difference in color, the western specimens being much paler, the basal space within the median band being, for the most part, of a delicate silver gray, which color is also extended to the thorax and abdomen. The white discal streak is also more strongly defined, and the suffused reddish patch of the lower wings usually much larger. Knowing nothing of the caterpillar, I am unable to say if any difference exists between it and its eastern relative, but it is possible that in this instance we have to deal with a new species. I prefer, however, at present to regard it only as a variety, suggesting for it the name of

Smerinthus occidentalis, var. Hy. Edw.

Fort Yuma, Ariz. San Diego. Sacramento, Cal. Carson City, Nevada. Dalles, Oregon.

Coll. H. E.

Tribe SPHINGINI.

Macrosila carolina. Clem.

As far as I am able to discover, this species was unknown in California until the introduction of tobacco planting, a few years ago. It is now very common in some portions of the State, particularly in the San Joaquin and Santa Clara valleys, and promises to be as great a pest to the growers of tobacco as it has proved in other parts of the continent.

Macrosila celeus. Hbn.

Rather rare at present, though it has been taken near San Diego, and in Mendocino and Napa counties. The caterpillar feeds upon the potato, and it is probable that, like the preceding species, this may be an introduction from the Atlantic coast.

Macrosila cingulata. Fab.

I have seen only two Pacific coast specimens of this insect, one from San Diego, the other from Santa Barbara. It is very abundant in the Hawaiian Islands, where the caterpillar feeds on the sweet potato (*Batatas edulis*).

Sphinx oreodaphne. Hy. Edw. (Proc. Cal. Acad. Sci., July, 1873.)

My friend Mr. H. Strecker, of Reading, Pa., has suggested to me that this may be only a small form of *Sph. chersis*, Hbn., and certainly there is a great resemblance, excepting in point of size, the largest specimen of *Oreodaphne* I have seen measuring only 3½ inches in expanse, the smallest 2¾ inches, while the average size of *Chersis* is 4½ inches. The markings, also, even in the most perfect specimens, are much less pronounced than those of *Chersis*, and the general color of the insect is much paler. If, however, Mr. Strecker's conjecture be correct, the synonymy will have to be

Sphinx chersis. Hbn.

Var. *Oreodaphne.* Hy. Edw.

Sphinx perelegans. Hy. Edw. (Proc. Cal. Acad. Sci., July, 1873.)

I am inclined to think that this and the following species are only two of others which will yet be found in California, having an affinity with *Sp. gordius* and *Sp. eremitus* of the Atlantic States. The only specimen of this species was taken by the late G. R. Crotch, at Gilroy, Santa Clara county, and is in my collection.

Sphinx Vancouverensis. Hy. Edw. (Proc. Cal. Acad. Sci., July, 1873.)

Since describing this species, I have had the good fortune to procure two other specimens, one from Portland, Oregon, and the other from the Big Trees of Calaveras county. They are so strongly marked as to put to flight any doubts I may have entertained as to the genuineness of the species.

Hyloicus Sequoiæ. Bdv.

I am only acquainted with one specimen of this very rare species, taken by myself in Bear Valley, Placer county, and noticed in Proc. Cal. Acad. Sci., July, 1873.

Hyloicus Strobi. Bdv.

Dr. Boisduval is himself in doubt as to the locality of this species, and without a careful examination of the type it is difficult to say whether it be Californian or not.

LIST OF SPECIES NOTICED IN THIS PAPER.

Arctonotus lucidus, Bdv. . . . . California, Oregon.
Hemaris Thetis, Bdv . . . . California.
Hemaris rubens, Hy. Edw. n. sp . . . . California, Oregon.
Hemaris cynoglossum, Hy. Edw. n. sp. . . . . California, Vancouver Island.
Hemaris palpalis, Grote . . . . California.
Ællopos tantalus, Hubn . . . . Mazatlan, Mex.
Euproserpinus Phæton, G. & R. . . . . Los Angeles, Cal.
Proserpinus Clarkiæ, Bdv . . . . California, Oregon, Vancouver Island.

Proserpinus Terlooii, Hy. Edw. n. sp....................... Mazatlan, Mex.
Chœrocampa procne, Clem. . ... Loc. dub.
Deilephila chamœnerii, Harris......... California, Oregon, Vancouver Island.
Deilephila daucus, Cram......... Arizona, California, Nevada, Oregon, V. I.
Philampelus Linnei, G. & R................................ Mazatlan, Mex.
Philampelus Achemon, Harris............. .... California, Oregon.
Smerinthus ophthalmicus, Bdv......... California, Oregon, Vancouver Island.
Smerinthus ophthalmicus, n. var. *pallidulus*, Hy. Edw .... California.
Smerinthus occidentalis, n. sp. (?), Hy. Edw.. Cal., Nevada, Oregon, Arizona.
Macrosila carolina, Clem.............................. California generally.
Macrosila celeus, Hbn...................... .... California.
Macrosila cingulata, Fab................. San Diego and Santa Barbara, Cal.
Sphinx oreodaphne, Hy. Edw.... .... California, Oregon.
Sphinx perelegans, Hy. Edw.................................... Gilroy, Cal.
Sphinx Vancouverensis, Hy. Edw...... California, Oregon, Vancouver Island.
Hyloicus Sequoiæ, Bdv.... ... . Sierra Nevada, Cal.
Hyloicus Strobi, Bdv.................. .... Loc. dub.

Col. Geo. E. Gray offered the following resolutions, which were adopted:

WHEREAS, The California Academy of Sciences has learned of the resignation of Professor Daniel C. Gilman of the Presidency of the University of California, and of his contemplated removal to Maryland; and

WHEREAS, The important services rendered by Professor Gilman, to the University and the cause of higher education, in California, are known and appreciated by this Academy. Therefore, be it

Resolved, That the California Academy of Sciences expresses to Professor Gilman its appreciation and approval of the work he has here accomplished, its confidence in his ability, and its testimony to the energy and devotion which he has exhibited in the performance of his duties as President of the University of California; that we thank him for the services he has rendered to the cause of higher education, here and elsewhere; that we regard his removal, so far as it affects this community, with regret, tempered by the conviction that in the new field of labor upon which he is about to enter, his varied acquirements, combined with many fortunate personal qualities, will prove fruitful in benefits to the entire country; that he will carry with him our respect as a fellow-worker, and our esteem as a fellow-member and a man.

Resolved, That the Secretary is hereby instructed to transmit a copy of the foregoing to Professor Gilman, and to the Trustees of the Johns Hopkins University at Baltimore.

REGULAR MEETING, MAY 2, 1875.

President and Vice-Presidents being absent, Dr. H. W. Harkness was called to the Chair.

Sixty-two members present.

Charles Wolcott Brooks read the following paper:

Origin and Exclusive Development of the Chinese Race —Inquiry into the Evidence of their American Origin, suggesting a great Antiquity of the Human Races on the American Continent.

BY CHARLES WOLCOTT BROOKS.

In searching for the origin of any race, the careful student is led to the barrier of pre-historic ages, where, amid the scanty remnants of remote antiquity, he seeks the missing links of a chain whose farther end has passed from the vision of general observers.

All ethnologists must recognize the importance of reviewing the early stages of religious belief current among any people, and laws governing its development, in any systematic study of their earliest origin.

Every act of man and every change in nature is self-recording, and although it may require the wisdom of a God to read the record, it yet exists, capable of being deciphered, and contributing to history.

With the advance of scientific knowledge, the human line of division between so-called historic and pre-historic ages is gradually receding. Science and historical criticism are opening many fields long hid in myth and conjecture. Much now classed as ancient mythology is but the lingering remnants of very ancient history, preserved and distorted by tradition. Most ancient nations in their written histories, have aimed as far as possible to ignore all antecedent civilizations, claiming for their own deified ancestry the origin of all men. Barbaric conquerors, filled with the spirit of battle, were early deified as gods, their descendants accepted as demi-gods were founders of reigning dynasties, and naturally sought protection by surrounding their origin with the supernatural. Transformations are frequent in the mythology of all nations, for religion, in whatever stage of its development, ever remains a grand, progressive, moral science. Many ancient forms of pagan worship glided silently into even Christian rites, when martyrs canonized as saints, noiselessly replaced the divinities of former systems.

As most early gods were ancient heroes deified, their worship was a nat-

ural manifestation of a low order of patriotism, which selfishly detested all nations but one chosen people. Each nation seems to have created its own god in the image of its highest ideal. Early ideas of God have been successively adjusted to the intellectual capacity of each progressive age, whose highest ideal has ever been the natural limit to its powers of mental or spiritual conception, possible under existing conditions of development.

Modern science and its civilizing arts have refined our personal conceptions and raised our ideal, by extending our limits of comprehension. Our own conceptions of the Great Architect, the Intelligent Mind of the Universe, as they exist to-day, are as much nobler than those of the ancients, as the magnificent enginery of this nineteeenth century excels the rude implements of early ages.

Notwithstanding this tendency to ignore antecedent civilizations, the most ancient peoples of antiquity, at the period of their very earliest records, show plainly that civilized life existed before their time.

In speaking of civilization at early periods, it is evident we cannot mean that of the printing press, telegraph and steam, as known in the nineteenth century, for no record of any such exists, but reference is made to a high state of early culture among cities of solid structure, with foreign commerce and mechanic arts, in contradistinction to barbaric, nomadic, or pastoral conditions.

Great maritime empires existed in very remote periods; and both Alantic and Pacific Oceans were crossed, and races and civilization widely extended in ages still called pre-historic. Whether we study the historical records of Arabian, Phœnician, Chaldean, Assyrian, Egyptian, Persian, Central Asian, Malay, Chinese, Japanese, Central American or Peruvian nations, we are amazed at the antiquity to which they lead us. Many oriental records now in process of translation, throw much light on the early movements of races. Asia in the far East was long considered the land of enchantment—a name given by superstition to early science. Astronomy was cultivated in Persia B. C. 3209; in India, B. C. 3101; in China, B. C. 2952; and in Egypt, B. C. 2800. Truly, wise men came from far east of Greece and Rome.

In Egypt, India, China, America and South Pacific Islands; evidences of a primitive civilization are found, which, in some instances, must have run its course long anterior to the age of Homer. Unmistakable traces of a primeval and ante-historic culture of the human race in America exist to mark the lapse of many ages of civilized existence. A knowledge of the western shores of the American continent has long existence in both China and Japan. That a restricted communication has existed by sea across the Pacific does not admit of question. When treating of the origin of the Japanese races several historical instances of their early trans-Pacific voyages will be described and discussed.

In comparatively modern times, enthusiastic specialists, versed in Hebrew traditions, have sought to locate the primeval source of all knowledge and culture upon the high table lands of Asia, where they pictured the radiant morning of civilization as immediately succeeding the completion of a cre-

ated world, perfected in all its parts, including man, the most complex being and climax of creation.

In a search after the origin of any race, we are first led to define a belief in the origin of man. I accept the hypothesis of universal evolution by a slow process of cosmic development, from matter which includes within itself the elements of all atmospheric, mineral, vegetable and animal existence, but latent until its energies are quickened by that progressive life-principle which ceaselessly radiates from the Great Intelligent Mind of the Universe, and is everywhere essential to awaken development.

This hypothesis, clearly within the scope of human thought, is able to stand the test of human reason, and now seems tangibly demonstrated, especially in the connected chain of fossils recently discovered and arranged by Professor Marsh, which visibly illustrate, by an incontrovertible record of natural history, the evolution of the *eques* or horse family, anchitherium, hipparion, etc.

All material things appear connected together by gradational forms, from the superior mental culture of man, the highest animal, to the protozean or lowest speck of gelatinous matter in which life manifests itself to human perception, onward through untold ages of mineral existence and cosmic conditions, ever in exact keeping with its pace of progress. All things that develop have life. Earth has labored to fit itself for the abode of man, and its labors are progressing successfully. Man came by regular stages of gradation from the monad, and his mental development keeps pace with and is restrained by physical surroundings. Immutable natural laws, universally and eternally in force, do not admit of any sudden, special creation of man, nor do they indicate that all forms of animal life could have been created at the same time. What has once occurred will, under similar conditions, occur elsewhere.

Man is the result of all inferior types, whose capabilities are within himself, making him a compendium of all created things. Fossil remains, found in different formations, are plainly revealing the stages of progressive transformation, each successive one having all the attributes of its predecessor, with more added. Crustaceous animals are succeeded by fishes, running into the saurian, thence into birds, next marsupials, followed by the mammalial, up to man. Animal development has unfolded, and is continually improving as the physical conditions of the globe are improved and refined, and higher conditions rendered possible.

Mind is an attribute of matter, each being instrumental and necessary to develop the other. Goethe says: "Mind cannot exist without matter, nor active matter without mind."

The man of cultivated mind has reached more than a mere physical being, having developed within himself a portion of that superior intelligence, the germ of which he inherits from the Mind of the Universe. The human mind is unmistakably progressive, and progression is an eternal principle. Hence, mind, the highest refinement of matter in man, is eternal. Our greatest revelation from the Infinite is in His works, where nature matures a supply for every want she creates. The power to conceive of immortality

therefore implies ability to attain it. This glorious truth is instinctively felt and recognized by every branch of the human race.

The origin of man has been gradually, yet hastily, traced as the result of a constantly progressive life-principle, awakening development in matter, successively evolving from cosmic conditions, minerals, plants, and all the lower forms of animal life, up to its climax, intelligent humanity. In man is to be found the highest physical ultimate of matter, endowed with that further refinement, a moral and progressive spirit, capable of ultimately unfolding his full physical and mental capacities. In human evolution, we can but outline the origin of existing physical forms, which periodically change with constantly modifying conditions. The immortal quickening principle which we inherit, can only be traced to the Infinite.

The animating principle of all existences, appears like a purer and more highly refined essence or form of electric force; equally manifest in mental and physical development, and exactly adjusted in all its different degrees to successive stages of progressive refinement. Natural law is universal. In the material process of electrotyping, man follows Nature's own method of building up metallic forms. The progressive life-principle of the human mind, in common with endless varieties of electric phenomena, manifests universal consistency in the positive and negative phases of a subtle activity. Some correlation with a Central Intelligence seems reasonably indicated, whence these mutually radiate as developing powers; alike in kind, varying only in degree, of force, purity and refinement.

It appears probable that the ancestors of the earlier types of mankind, were evolved, by gradual development, near the oldest parts of continents, along their central summits, upon such portions as first acquired a soil after emerging from a hot primeval sea. Primitive man, at first a speechless animal, may have appeared as a distinct variety of the animal kingdom, in the case of a single pair, from which all human races have multiplied, and differentiated according to the surrounding conditions of their local abode. If so, the physical conditions of certain localities have been far more favorable to the advancement of certain races than others, and early human history must be by *race* and not by *nations*, as communities of individuals come but with the first steps to culture.

Within the limits of races best known, languages and families of languages are found, which preclude any common linguistic origin. It therefore follows, that if man constitutes but a single family in the order of Primates, represented by a single *genus*, the formation of language must have commenced after the still speechless primordial man had diverged into races, and differentiation had set in. With the development of ideas in the mind, however rude at first, and organs capable of articulation in the body, language was a consequent result, under the operation of universal law. The Great Intelligent Principle of the Universe pervades the entire world, as our mind fills our whole physical frame. The manifestation of this principle we call Life, which all things possess in greater or less degree.

Development is ever progressive, although mutability appears to mark every advance, yet no breach of continuity has occurred. Every order has proceeded by natural process from another antecedent. The superimposed

strata which constitute the crust of the earth, form a gauge of relative time, for which human chronology scarcely affords a unit of measure. It is perfectly certain that during the cretaceous epoch, a comparatively recent period in the world's history, none of the physical features existed, which mark the the present surface of the globe. Continents have undergone movements of elevation and depression, their shore lines sunk under the ocean, and sea-beaches have been transferred far into the interior of pre-existing continents. All dry land has been submerged, excepting recent volcanic products and metamorphosed rocks. These introductory facts are necessary to ethnological research.

A cooling sphere, having acquired a solid crust around a nucleus of fiery liquid, in parting with its heat by radiation into space, must contract, distorting its outward surface by pressure, raising mountain ridges, and depressing corresponding valleys, where the first seas became located. Sun and moon, obedient to the law that bodies move to each other in proportion to their masses, and inversely as the squares of their distances, attracted tidal movements in molten fluids under the crust, in hot salt seas, and the thick unrefined atmosphere above. Fluids as well as other matter were more gross during their primitive states. Rupture and re-formation succeeded one another, until the primitive igneous period of angular azoic granite, became sufficiently hardened to withstand the ordinary pressure of inward forces, gradually preparing to furnish physical conditions, suitable to begin the evolution of animal life in its most elementary forms, corresponding with the imperfect condition of existing elements.

During the mighty struggles of the unrefined elements, internal convulsions sent the hot salt sea surging over a large portion of the surface, and sedimentary deposits formed new stratifications. Substances impregnating the waters united in forming crystals. The waters, having raged from point to point, were obliged to seek an equilibrium, and retired to the valleys, forming various oceans, seas, lakes, and rivers.

In the early carboniferous period which succeeded, the extra nitrogen and carbon were rapidly absorbed from the air, and the density of all exterior elements greatly reduced. A period was thus established, where, under favorable auspices, and in limited localities, the very imperfect initiatorial orders of vegetable and animal life appeared. An infinity of embryo existences are contained within the crust of the earth, awaiting the slow process of development. Life generated at the initial period was of the very lowest order, unable to support or reproduce itself to any considerable extent. From this threshold of progression, conditions became sufficiently advanced to admit of the systematic reproduction of species; the age of spontaneous generation having performed its limited duty in the general ripening of the globe, may have ceased and passed away with conditions which sustained it, and matter, within itself, matured the power to reproduce its kind, endowed with a progressive principle, destined eventually to evolve its ultimates. This hypothesis explains why spontaneous generation may have had its day and subsequently ceased.

Crinoides, *conchiferæ*, *crustacea*, *polypi*, and *polyparia* successively appear as elements are advanced to the necessary conditions to sustain such forms of

life. The systematic development of *flora* and *fauna*, in successive ages, extends in an orderly chain from their dim and distant beginning, to our own time, through universal changes of atmosphere, climate, and oscillations of temperature. A continual unbroken chain of organisms has extended from palæozoic formations to those of our day, governed by law that knows no change. Each species has gradually evolved from its predecessor in an antecedent age, by a gradual modification of its parts, culminating in the age it characterizes, and fades away in succeeding ones.

Change is everywhere the soul of nature. The race which first acquired the human form, and became properly entitled to be called Man, probably ascended from one original type, which has since diversified, and may in this age be divided into five distinct *varieties* (not types), generally classified as Caucasians—*white*, Mongolians—*yellow*, Malayans—*brown*, Americans—*red*, and Negroes—*black*.

As white and black are apparent opposites, and science shows the white race to be superiorly developed, it is fair to presume that primitive man was black; subsequent nations, brown; their branches, red; from these sprang the yellow, and thence the white. Under local changes of atmospherical and physical conditions, of climate, food, etc., the original black became modified to a permanent brown. In like manner one shade and color after another became permanently established. As with complexion, so also with stature, symmetry, and strength. Proper use develops, while disuse brings decay.

Some anatomists have claimed that color may be produced by the arrest of utero-gestation, or is governed by its relative duration in races, thus "causing the ultimate portions of the blood to become so assimilated with the cellular and serous tissues of the fœtus as to render the body variously colored—black, brown, red, or copper color." *Lusus naturæ* have illustrated this fact.

The present of any race depends largely upon the physical conditions of the soil they inhabit. When these remain unaltered, the race cannot advance, unless it can develop, by brain power, sufficient ingenuity to overcome the drawbacks to advancement; such as draining marshes, heating dwellings, importing ice, etc., thus growing, in spite of natural restraint, faster than the slow process of natural evolutionary changes would permit.

Modifications in different types of vegetable or animal life neither progress equally nor evenly. There is no intrinsic necessity that they should undergo modifications at all, unless conditions change, or in the case of man, who invents ways of surmounting natural conditions. To him the extreme North becomes habitable by the use of warm clothing, artificial heat and light during long winter nights. By a restless spirit pressing him forward and a judicious control of elements, he is enabled to obtain artificial conditions far in advance of the physical condition of his habitation, and thus pre-naturally exalt and develop himself and his race. With the loss of these conditions the highly developed man would perish or relapse into a comparatively barbaric state, to where his development would exactly agree with his actual physical surroundings.

Darwin unmistakably illustrates the tendency of all forms to variations, which when once produced, join in equal battle to survive and supplant their

progenitors and all others. The fittest will maintain itself and the others perish, the parent and derived forms being equally dependent upon their individual adaptability to surrounding conditions. Thus, certain localities still exist in the condition of ages long past, where inferior races yet flourish and find themselves better off, more competent to deal with difficulties in their way, than any variation derived from their type. While conditions continue unchanged they remain unsupplanted by other forms, and their type becomes very pronounced. Exact reproductions are rare. Amid infinite similitude there is infinite diversity; and imperfection is a vast fact, which must always be taken into account in all hypotheses. "Animal beauty arises from the perfect balance of physical parts and the rhythm and perfection of their action." It is probable that no perceptible change has taken place in the Chinese race for many years, because in that time the incomplete changes of physical condition in their country have not admitted of it. Wheat found in tombs with Egyptian mummies, when brought from darkness into sunlight and planted in congenial soil, grew and produced wonderfully, but could never have developed without a change of conditions. Change is imperative to progress.

A complete knowledge of embryology furnishes an unerring record of the origin and development of any form of animal life; for the embryo of higher types, while in process of maturing, pass successively through a recapitulation of all forms by which their species ascended by evolution to their present condition. Since conception, each human being has passed rapidly through modifications, the counterpart of the graduated forms through which his race has been slowly built up, and his present condition reached. Thus, we have a history of human evolution republished in every case of reproduction.

Man, as traced by his embryotic development, commenced, when in darkness, the cohesion of two or more gelatinous molecules, impelled by a constantly-progressive life-principle, united to form a microscopic zoösperm, capable of preserving its new condition in a thick and heated liquid. The proportionate duration of early life in warm water is revealed by the first nine months of his existence, during which many successive but correlated forms are assumed. Dr. Cohnstein, of Berlin, (quoted in the *Lancet*, May, 1875,) "has determined by means of the thermometer that the temperature proper to the *fœtus in utero* is higher than that of the mother." The hot salt sea in which early life developed, is here typified. The period of atmospheric air having arrived at birth, emerging into light, his aquatic life ends, and becomes terrestrial and aërial. New elements of food are supplied, and the mode of nutrition changed. For awhile his food continues liquid, and he sees, hears, and notices but little. By degrees he arrives at a consciousness of the solid world, first rolling, then creeping, seal-like on four limbs, then sits upon his haunches, and finally walks erect, at first tremblingly, then playfully, but firmly, at last. This reveals how nature required successive physical conditions, to acquire progressive results. Each being owes his present bodily form, to ascent through a parentage, each change of which has passed away, after accomplishing its intended purpose, a culmination reached by degrees, through countless generations of improvement.

In due time, children acquire teeth, and another change of food ensues,

and hair usually darkens. A second set of incisor and carnivorous teeth soon mark another stage of progress, and youth succeeds childhood, bringing an expanded development of bodily form, passions, and intellectual power. No individual can reproduce until he reaches the full maturity of the type to which he at present belongs, which prevents the race from receding, by reproducing a lower type. Leaves grow out or drop off, but never grow back. Nature never retrogrades; advance or perish is law to the individual.

Man can imitate any animal of his species, but no animal can follow man beyond its developed powers. Many traits, exemplified in lower animals, are successively developed in children, and overcome by proper control; such as gluttony, cunning, and deceit—the latter a lingering trait of weakness, general with inferior races. They repeat the antics of a very active and mischievous race; their first attempts at drawing, resemble the rude figures made by our primeval ancestry and present wild tribes; furthermore, like "children of the forest," our younger children have not reached the age of self-cleanliness.

The impulsive ferocity of youth, and cooler maturity of age, are but characteristic types of human transformation in the evolutionary procession. Our lives acquire a double significance, when we find we are building an inheritance for every one of our descendants, while our race continues.

In our growth, we *re*-evolve, concisely, the story of our race's lineage, as in "*the house that Jack built*," each succeeding verse comprehends all its predecessors. Our present bodies now barely float; for, as man acquired his upright stature, his frame must have increased in weight and hardened into greater rigidity; while the pelvis, to sustain additional weight thus put upon it, enlarged, thickened and increased his gravity.

The head of the human species seems originally to have been large in proportion to the body, exhibiting a promising germ thus early advanced, a fact to which the race may owe its present superiority; and, possibly, this early development of the organ capable of acquiring knowledge, may account for peculiar sufferings, visited upon woman, more particularly among the most intellectually developed.

The highest type of man has been artificially advanced beyond the condition of some portions of the physical world. Miasmatic swamps are yet insufficiently reclaimed by time, to permit a white man's existence where they continue. Their present condition would involve his speedy illness and dissolution. Lower organizations, congenial to and in harmony with such conditions of physical development, may exist and flourish there; but more refined types of humanity, require the most perfected physical conditions, for their perfect enjoyment and highest attainments.

Centripetal law has consolidated the Chinese into a positive and exclusive people, who delight in ignoring the centrifugal or complimentary force, which induces dispersions. They have long clung to unique customs and dress, resisting change or improvement. In their stereotyped form of frozen civilization, differentiation has been arrested, and a peculiar type itensified. Unalterable fixedness in forms of belief, and habits concreted by centuries, furnishes convincing evidence of great antiquity. The black races are ethnologically far less developed, and having no fixed belief to displace, are more readily converted to any religious sect.

We cannot avoid admitting that the Chinese are one of the oldest families of the ancient world; yet they are by no means the oldest. Until the seventh century before the Christian era, they were perfect strangers to every form of idolatry. Pure Chinese appear like a race absolutely distinct from nations by whom they are surrounded, differing in physical characteristics of form, color, and expression; in language, in their written characters, their literature, and religious observances. Unchanged by foreign conquests, by extensive intermixture with any foreign race, they have developed within themselves, preserving and perhaps intensifying their type; governed and civilized by the principles contained in their own classic literature, and in their pure and excellent book, the Chou-king, compiled fully 3,000 years ago, from their more ancient literature, much as many suppose Moses to have compiled the Pentateuch, or as Heroditus compiled early Grecian history.

China has her ancient picture writings, but no ancient idols. She has her literature older than the Sanscrit races. When the great pyramid of Menes was built, in the fourth dynasty of Egypt, B. C. 3893, we find one vast and expanded system of idolatry throughout Asia, and the countries bordering on the Mediterranean, all worshiping emblems, more or less types of the sun or solar principle, China standing alone—far back in the twilight of history—is a solitary exception on the continent of Asia.

Language is a test of social contact, not of race. Undoubtedly the first expression of human thoughts were by configurations of countenance, such as smiles and scowls, indicating pleasure, dread, or anger. With the invention of complicated forms in language, capable of complete expression without emotion, came deceit, frequently followed by loss of harmonious social relations, and developing combativeness. No primitive history, at present known, conveys any reliable account of an aboriginal language much anterior to that of China; although that of the ancient people of Yucatan and adjoining American nations, as shown by picture-writings on their monuments, appears to have been more ancient.

Both peoples, in common with the Egyptians, expressed thoughts by picture-writing and in hieroglyphics. While other surviving nations improved upon this original style, by developing the phonetic; inhabitants of China alone, became exclusively confirmed in their monosyllabic language, and their manner of vocal communication, is still very peculiar and spasmodic in sound and utterance. Their hieroglyphics, which, in early ages, expressed a single substantial thought, were subsequently assumed as syllabic representations, and became synthetic or compound forms of expression. Thus, to-day, 216 Chinese radicals are made use of, in over 50,000 ideographic combinations.

To investigate this subject, requires extensive research in a multitude of directions—physiological, linguistic, religious, traditional, geographical, and migratorial—for it is often by their mutual comparison only, that satisfactory results are reached. The wider view we can compass, the clearer our understanding of general laws. There is in force a law of decreasing vitality, as well as of evolution, both alike depending upon the refinement of surrounding conditions. Great disturbances have affected the earth's surface and all living things, since the tertiary period, when our present zoölogy fairly started

into being. To all these considerations, must be added the ancient migrations which the different families of mankind have passed through, under the changing conditions imposed upon them by geographical and climatic necessities, and thus a systematic arrangement of facts is finally indicated Physical geography teaches us that of the two great elements, water and land, the latter, which is matter in a more advanced form, is far superior in the animal and vegetable life to which it gives origin; likewise, that low and swampy land is fatal to health and the highest development of man. Geology and Palæontology show this to have been equally true of the *flora* and *fauna*, in ancient days.

Neither tropical Africa nor Asia are adapted to the Anglo-Saxon constitution; every white colony there has been wasted by sickness and death; yet this is the native and natural climate of the dark races, who are there as much at home as is the polar bear on the shores of Greenland. When at Saigon, on the Meikong river, I was told by an officer of the French colony, that 24 per cent. of French troops stationed there died annually. The British occupation of low lands in the southern portion of India, is scarcely more than a military possession, so far as Europeans are concerned, who cannot long live there, but would soon become extinct but for the constant influx of fresh immigration. There, a European struggles for existence, a prey to fever and dysentery, and is unequal to severe labor. White women, as a rule, are especial sufferers, rallying but poorly from any illness. White men must yield the tropics to the dark races. The reverse is also true; negroes are not comfortable in the frigid zone. The American residents of New England States, as at present constituted, have a continual fight with existing conditions of climate, and their survivors and descendents, now in process of acclimatization as a race, are assuming a somewhat typical form.

Whenever we examine nature, we find a perfect adaptation of animals to the circumstances under which they live. The constitutional temperaments of the different races seem to vary. The dark races are less developed than the white; they have a less nervous sensibility, for their physical organization is less delicate. Van Amridge says: "The dark races expire less carbonic acid from their lungs than the white, but transpire the fetid matter chiefly by the skin." According to Dr. Knox, the nerves of their limbs are one-third less than the Saxon of equal height. Great differences of shape in the pelvis of different races, have been classified by Doctors Vrolik and Weber, who thus report the four principal races: "The European is oval; the American, round; the Mongolian, square; and African, oblong."

The characteristics most relied on for the discrimination of races, are the color of the skin, structure of the hair, and confórmation of the skull and skeleton. Transitions from one to the other are so gradual, that it seems almost impossible to draw any exact and arbitrary line of inter-demarkation. We now see the various branches of mankind confined to distinct localities, mainly bounded by isothermal lines, with distinction of form and color, with different social relations, religions, governments, habits, and intellectual powers. Wherever men have migrated, they appear to have found and displaced an aboriginal nation, and no record is believed to exist of any people ever migrating to a land which they found entirely destitute of inhabitants,

in some of the various stages of human development. Adelung reckons the total population of the earth as 1,288 millions, professing 1,100 forms of religion, among which there exists 3,664 known languages or dialects, viz.: 937 Asiatic, 587 European, 276 African, 1,624 American. These are significant facts.

Sir Charles Lyell is inclined to admit that an imperfect form of man was living when the tertiary stata was deposited. Agassiz, who pronounced America the oldest continent extant, measured the coral growth during a given number of years along the southern half of Florida, which, he asserts, has been formed by accretion during the geological period known as recent, and must have required not less than 135,000 years to form. We may arrange epochs in their order of sequence, but not of date, for in contemplating the vastness of such a past, the mind becomes lost in amazement at the vista opened into antiquity. The histories of China contain records of the past, which modern chronologies have insufficient room to measure. The limits of history are steadily receding, and Greece and Rome are taking their proper positions in a comparatively modern era. Science is developing unanswerable proofs of the greater antiquity of the human race, than current ecclesiastical histories have been supposed to allow. Greater freedom in chronology is absolutely necessary. No sound religious principles have aught to fear from true interpreters of antiquity. Truth, in all its natural simplicity, is susceptible of proof, and reason is its steadfast supporter. Nature's own religion is grander than any human conception. In the dark ages, mysteries, miracles, and absolute imposture stood in the way of absolute truth. Evolution gives to the Infinite higher attributes, and more nearly connects him with all created things. The God of the true scientist is grander and more comprehensible to mankind. It takes us half our lives to unlearn and eradicate errors honestly taught us in youth, with perfect good faith and intention, which persistently cling to us until displaced by the sound reasoning powers of maturer years. Each conscience is but the result of its own moral education. It is composed of ideas it has fed on. Many imbibe, hereditarily, the opinions of their forefathers, and venerate them because they were first upon their mind, which circumstance alone produces to them an unsophisticated conviction of their truthfulness. None are free but those whom Truth makes free:

> "Most men by education are misled,
> They so believe because they so are bred;
> The priest continues what the nurse began,
> And so the child imposes on the man."

America was undoubtedly peopled many ages before Julius Cæsar landed in barbaric Britain, and many of the colossal structures, whose ruins still excite the wonder of the wandering Indians of Central America and Peru, doubtless passed from use long before the Tartar conquerors in Central Asia drove their hordes eastward, or Attila and his Huns swept his legions westward, from the great wall of China and the steppes of Ancient Tartary.

Chinese historians assert that in the fifth year of the reign of Yao, B. C. 2,353, strangers from the south, of the family of Yoüe-Tchang, brought, as a

present from a maritime kingdom in southern seas, a great turtle, three feet long by three feet wide, and very old, on whose back was written a history of the world, from its commencement to that time, which Yao ordered transcribed and preserved. Turtles have long had a peculiar religious significance in Japan, and also among American aborigines at Copan, where a splendid stone altar of great antiquity, in the image of a similar tortoise, yet remains.

Chinese culture, dwelling apart in the south-eastern extremity of Asia, has developed and retained distinctive national types, coldly conservative, while nations less peculiar, and perhaps more adventurous, rose, scattered, and passed away almost by scores. The isolation of their peculiar civilization must have resulted from the physical conformation of the spot they occupied, encircled by protecting ranges of mountains, and forbidding natural barriers.

Eminent Chinese historians, after describing the fabulous and mythical ages, which are imperfect and idealized recollections of events, peoples, eras, and civilizations; and renowned individuals whose exact history had become confused, extinct or legendary, when their first authentic records of ancient history were penned; come to the reign of men. Greek history appears limited when looking beyond into Oriental records, and proves but a scanty stream leading to a broad ocean beyond.

The deified rulers are naturally the most ancient, and are succeeded by demi-god descendents, in a sort of middle age. The advent of conquering heroes from a foreign soil, by introducing a new element into history, may have changed the national era. A careful study of the various ancient histories of the world has led me to infer, that, generally, rulers who are said to have descended from the gods, were merely successful invaders of the country where they died, and were there canonized or deified. Being born in a foreign land, no local record existed of their parentage, and it was easy to ascribe their origin to supernatural causes, while their death being among the people whose traditions have come down to us, was witnessed and recorded.

All scholars experience difficulty in tracing up and locating ancient places, as most of them were given new and foreign names, by conquerors and explorers. Since the days of Tyre and Sidon, and the ancient and long continued sway of the South Arabians declined, and gave way to the rise of great monarchies in Western Asia and India, places have received new rulers and taken new names. This is true throughout history, of all countries, and is more recently illustrated to us, in the saintly names given by Spanish and Portuguese explorers; or head-lands and islands re-named for British seamen and their patrons. A less troublesome impediment to accurate identification, is found in translated names.

The progress of science, and linguistic and historic researches, continually supplements our knowledge of the mighty past, whose history must now be worked back by degrees, and every fact capable of yielding testimony, preserved and utilized. Chinese records, extending to B. C. 3,588, may yet render valuable aid in perpetuating much that was destroyed in the lost libraries of Phœnicia, Chaldea, and Egypt. The first era of Chinese history is without dates, capable of being accurately fixed by any measure known to us

at the present time. So of Methuselah's age. We cannot believe that the duration of human life changed suddenly from hundreds of years to three score years and ten. The change, if at all, was in the human measure. During our present century, the average longevity of Great Britain has increased nearly ten years. The true "*elixir of life*" is a scientific knowledge of the limits of our being, and wisdom to use our powers so as to obtain their utmost capabilities. Wisdom is the best use of knowledge.

This early Chinese era consisted of three dynasties, who, successively with their descendents, ruled the kingdom of China, whose dominion had not then spread into an empire, and the aggregate terms of their reigns must have extended over a long period of time. This period may represent the rule of early Asiatic aborigines, developed upon the soil of China.

Chinese historians commence their second and more authentic era with the reign of a sovereign named Tai Ko Fokee, or Great King Stranger. He commenced his reign B. C. 3,588, and from this founder of their line of monarchs, they have preserved a national history and true chronological succession of their rulers. His name seems to imply that he was a foreign conqueror, who occupied the country, and doubtless, at the time of his conquest, took no pains to preserve the records of superseded dynasties, which come to us only in the form of tradition.

The pictorial representations of King Fokee which have come down to us, represent him with two small horns, similar to those associated with the representations of Moses, the Hebrew law-giver. He and his successor are said to have introduced into China the hieroglyphic characters for picture writing, somewhat similar to those found in Central America, and from whence the ideograms now in use are conceded to have been derived. He taught his people the motion of heavenly bodies, the twelve celestial signs, and divided their time into years and months, besides bringing them a knowledge of many other useful arts and sciences. The sudden advent of so much new knowledge, brought by one man, indicates that he came from far away—from a country with which no previous communication had existed. As he introduced a new measure of time, we can but estimate the duration of eleven reigns which preceded him.

Probably the solar day was the earliest measure of time; then, the lunar month; and lastly, the solar year. The various words used in all languages, and interpreted to us years, meant, simply, the *periods of time* which at the moment constituted its measure. Thus, if Methuselah lived 969 periods of time when the lunar month was the accepted measure, he died at 74½ years of age, which is not improbable.

The great Chinese history of Tse-ma Chi-ang, written B. C. 122, and purporting to be an accurate transcript of all earlier existing histories, which it was desirable to consolidate and preserve; narrates events, chronologically, from the reign of Hoang-Ti, which commenced B. C. 2,697, when he was eleven years old; during his minority the kingdom was governed by wise and prudent counselors, who, it says, took great care of the young monarch, and educated him in all the useful arts and sciences then known. It is recorded that during his reign physicians first learned to feel the pulse; the magnetic needle was first used, pointing to the south; and civilization greatly

advanced. He lived a useful life, was greatly respected, and died at a ripe old age. During a portion of his reign, a powerful revolt was successfully put down, indicating a mixed race, with the antagonisms of conflicting opinions. Five of his descendents succeeded, in turn, to his throne. Then came *Tai Yao*, followed by *Yuti Tsi Yune*, B. C. 2,294, during whose reign a great deluge occurred in Asia, which flooded fifteen provinces of China and drowned great numbers of inhabitants. Some portions of the country remained under water for several years thereafter.

This rupture of a natural barrier, which held in check some extensive inland basin of water, existing at a higher level, occurred just fifty-four years after Archbishop Usher fixes the arch-catastrophe of Hebrew tradition, and was doubtless like the Noachian flood, a crisis in the physical history of the region where it occurred. It is highly probable that the great interior alkaline deserts of North America, where the successive water lines around the surfaces of every elevation of its various levels, clearly indicate the former presence of vast inland basins of water; have at some remote period been, in like manner, drawn off and precipitated upon lower levels of this continent, in their journey towards the common level of the ocean. This is also shown by the presence of ancient river beds across the present summits of the Sierra Nevada Mountains. Nothing seems to impede the execution of unerring physical laws, and in the consideration of general history, natural science shows no relation between such physical calamities and personal guilt.

B. C. 2,233, the next Emperor, *Ta Yu*, caused canals to be cut, to convey to the sea the immense bodies of water which, during the reign of his predecessor, had been precipitated upon and overflowed so large a part of China. By this means many deep river beds were finally cut, and continued to be worn away by the receding waters, until the whole country was freed from inundation.

His eleventh descendent and successor was a tyrant, and was banished in the fifty-second year of his age, and king *Ching Tang* came to the throne, B. C. 1,766, and died 1,753 B. C. During his reign a great famine existed in China, which the records say lasted seven years. Joseph's famine in Egypt occurred B. C. 1,707, or forty-six years after this date. These coincidences are merely cited as suggestive to historical students.

It is desirable that the historical records of all ancient nations should be sought out and compared; and to our linguistic and archæological students on the Pacific, the early histories of China and Japan should be made the subject of careful study. Much mental and social cultivation existed in Asia when Europe was yet in her dark and undeveloped ages. China and Japan, as well as all the nations of Asia, yet contain many ancient records, that may well repay careful study, revealing traces of a civilization whose history is incredibly remote. Ere the ancient respect for sacred records has become impaired, and they are cast aside or destroyed in the ecstasy of a new-found religion, or the mechanical wonders of a scientific civilization, earnest and reliable students may acquire much important testimony among the archives of India, China and Japan. Few ancient races have preserved a literature of equal value with the Chinese. The great past of prehistoric humanity bears traces of activity and commercial intercourse throughout Asia.

About five thousand years before the Christian era, the Sanskrit branch of the Aryan race invaded and occupied Northern India, while the Arabian Cushites, dwelling in Arabia, held control of Southern Arabia. These South Arabians held innumerable colonies, and were unrivaled in power and commercial dominion. They early established great influence as a maritime people along the coast of South-western Asia, colonizing much of the Asiatic seaboard in the deepest antiquity,—not, however, including the present Chinese territory, but exercised a widespread influence from the extremes of India, even to Norway, acting an important part as pioneers in spreading and developing early civilization. The nomadic tribes of Asia have been classed as of Semetic origin.

China, although well known, and mentioned in the ancient Sanskrit writings, under the name of *Yama*, was never included in statements of the migrations of races and peoples throughout Western Asia, Hindostan, and the islands of the Indian Sea. In remote antiquity, the Chinese nation appears to have lived within itself, cut off from active communication with any neighboring people.

According to Arabian traditions, *Ad* was the primeval father of the pure Arabians, and built a city in Arabia which became great and powerful. The Adites are referred to in the earliest dawn of Arabian history, as enterprising, rich and powerful, having great cities of wonderful magnificence. They were skillful builders, rich in gold, silver, and precious stones, showing them acquainted with metals. Numerous appliances of our civilization had their origin far back in the obscurity of ages now pre-historic, and Adam may be but the Hebrew tradition of the ancient Adites of Arabia, who must themselves have had a long line of ancestry, to have developed and acquired such civilization. Adam was, perhaps, simply the ideal embodiment of a *beginning of humanity*, typified to the Hebrews by an Adite patriarch, beyond the experience of their own history, into which he was adopted by Moses, *as the ancestor of their race*. It was an effort to extend their national lineage far back to an original First Cause. The distinctive Hebrew race descended from Abraham, that magnificent sheik, the mighty Mesopotanian prince; Israel's ancestral hero and first distinctive Hebrew personality; great grandsire of the princely Joseph, Lord Chancellor of Egypt, Prime Minister of the first Sesostris, and monotheistic chief of an illustrious line. Thus he stands, in bold relief, on the canvas of tradition, as a great leader of human kind in the period comprised in the first essays of Hebrew literature.

Our opinion of the general inaccessibility of China from other parts of the continent of Asia, in early times, is confirmed by a passage in the history of Besorus, relating the conquests of the Arabian sovereign, *Schamar Iarasch, Abou Karib*, who reigned over Chaldea, and 245 years before the rise of the Assyrian empire carried his arms, B. C. 1,518, into Central Asia, occupied Sarmacand, and for a long time attempted, without success, the invasion of China. Humboldt describes an Himyatic inscription existing at Sarmacand in the 14th century, in characters expressing, "*In the name of God, Schamar Iarasch has erected this edifice to the sun, his Lord.*" All facts go to show that migrations over Central Asia, from Arabia across the continent, must have passed north of China, (which country seems to have maintained

her individuality nearly intact), and reached the shores of the Pacific near the peninsula of Corea, which is still inhabited by a populous nation, quite unlike the Chinese race. Many aborigines of Central Asia were doubtless driven toward the coast by these Arabian conquerors. These South Arabians were a people older than the Aryans. The great ages of Cushite civilization, to which we are told they succeeded, closed at a period which was very ancient when the book of Job, the oldest book of the Hebrew scriptures, was penned as a Persian poem.

Testimony is universal that the oldest nations succeeded older pre-existing peoples, and generally received their highest ideas from abroad, showing a descent of ideas as well as of blood. A constant admixture of races, peoples and nations has been successively going on for ages. It is only in some secluded spot that we may, at this late day, discover traces of anything approaching to an early type, with slight recent admixture. Such specimens, if they exist at all, cannot but be extremely rare, and, like the Miauts of China and some remnants in the Tyrolese Alps, inhabit regions virtually inaccessible.

The huge stone structures, cities and temples being unearthed in Yucatan, argue an enormous early population. The ruins of Copan, and disintegrating pyramids of Palenque, are convincing proof of a great pre-historic race in Central America, at an immensely early period; which must have occupied the same relative positions toward North and South America that Asia Minor did, in remote ages, to Central Asia and Africa. The peculiar construction of all the arches found among the buried cities of Yucatan may lead to the discovery of races cognate to its early inhabitants. The same principle of arch was used in very early times by Egyptians, Greeks, and Etrurians.

Notwithstanding the frequent disastrous fires, and destruction of records by conquerors and founders of dynasties, who have annihilated much valuable material, China, Japan, and the interior of India have many copies and manuscript translations of very ancient works and histories, long retained among their sacred treasuries, rich archæological prizes for modern explorers to unearth, equal in interest to the lost history of Iran, mentioned in the Dabistan and other Asiatic writings.

By an extended research into ancient histories, many plausible reasons are found, which argue the possibility, and almost probability, that some early aborigines of the pure Chinese race may have crossed by sea from the coast of Peru to China in an early or remote age of the world. Recent travelers in Peru inform us, that its aboriginal races have, like our North American Indians, become nearly extinct; and the only remaining traces are found among the China-chola, a mixed result from Spanish and Portuguese ancestors. Last year my attention was called to an article in a South American paper, describing the remnant of a race of aboriginal Mongolians or Chinese, found among the high table lands upon the western slope of the Andes.

Phœnicians and Egyptians, who each received hieroglyphical characters from a common source, originating in an older people, ascribe them to Taut. The Chinese ascribe them to Tai Ko Fokee, their Great Stranger King, who reigned B. C. 3588. Many curious coincidences point to the supposition that

he may have brought them from Peru or Central America, where, among ruins still existing, there has been discovered much early picture-writing, closely corresponding to early Chinese characters, comprising the 216 radical ideographs now used. Thus, heaven is expressed by three horizontal lines, slightly curved; and earth by a cross within a circle. In discoveries at Copan is a figure strikingly resembling the Chinese symbol of Fokee, both nations representing him like Moses, as a lawgiver, with two small horns. Many figures on Peruvian water-vessels, of great antiquity, are identical with those found in Egyptian temples; birds' heads, for example, attached to figures resembling a comma, but intended to represent tongues; and other remarkable coincidences. Either one people learned from the other, or both acquired these forms from a common source. Many physico-geographical facts favor the hypothesis, that it is more rational to conclude that Egypt received them from America, through China—possibly through Fokee, or some predecessor in very remote ages. Recent scientific explorations are reported to have exhumed Chinese sacred mottoes, carved on tombs in Egypt—counterparts of phrases in use to-day—revealing the existence of an intercourse when China was ruled by kings anterior to Moses.

The present written language of China is undoubtedly an imported method, advanced from such picture-writings as those of the ancient Peruvians, or primitive hieroglyphical signs of ancient Egypt. Among some nations, mental progress evolved a simple alphabet, while others remained content with the increasing complications of ideographic signs, for syllables and objects. Egypt, like China, was tenacious of her individual peculiarities, and long retained her hieroglyphic type. She finally abandoned it, while China clung to but improved it.

The South Arabians and their descendants, the Phœnicians, having an extended commerce established throughout the Indian Ocean, with every known shore, undoubtedly passed more readily into a simple phonetic alphabet, better adapted to the practical wants of a commercial people. Tablets have been discovered among their ancient ruins, by which the various changes are readily traced.

Chinese characters, so long surrounded by the ultra conservatism of an impenetrable isolation, have undoubtedly developed from these common forms of natural objects, and subsequently been adapted to easy and rapid writing, with a peculiar style of brush, and their manner of holding it.

The consideration of whether the Chinese people originally developed in Asia or abroad, bears an important relation to the origin of the Japanese race, the subject we are ultimately investigating and shall consider in our next paper. In seeking the initial points whence migrations have diverged, we naturally gather all possibilities, whence we select probabilities, in the hope of finally eliciting absolute truth. We shall be compelled to limit this already lengthy paper to setting forth certain fundamental principles useful in research; and to a collection of evidence, the full discussion of which will necessarily remain for a future occasion.

Without, in any manner, endorsing the following hypothesis, we shall simply aim to shadow forth a few *possibilities*, which the consideration of many curious facts have suggested during the laborious details of an elaborate search.

How came the Chinese—a people so ancient, so reserved, and so wholly unlike their surrounding neighbors, or indeed any other race upon the continent of Asia—to be thus alone in this corner of a continent, walled in apart from all neighboring races? We may reasonably doubt the assumption of any spontaneous growth in the country they now inhabit. Conjectured migrations among still speechless societies, at an epoch anterior to the formation of nations, are beyond our present ability to trace. We can only surmise whether each continent evolved a type of manhood separately, or whether all higher races have resulted from the various differentiations and dispersions from a single locality, of a common ancestor already developed up to the lowest types of a speechless animal, tending to manhood.

Our best researches indicate an enormous antiquity for man on the American continent, and an advance in general form and brain capacity, with, doubtless, a modification of color, since a very early period. In very remote times, there appears to have existed at least two very distinct populations, differing, in fact, more widely than any existing aborigines of the continent. Portions of North America had been occupied by races far more advanced than its occupants when recently discovered by Europeans. Originating, perhaps, at a very early period in the elevated centres of the American continent, wave after wave of races may have rolled eastward and westward, or northward and southward, to a certain extent, only identified in America to-day by slight signs that mark the nearly extinct descendants of the people with which they amalgamated.

Dogmatic theology retreats before scientific truth. No one will, at this day, pronounce the self-registering records of nature grave heresies. They are vastly more enduring, authentic and reliable testimony than the precarious text of human narrators. It seems a crime against true religion to hang the integrity of its moral principles upon the validity of statistics in any book which merely illustrates, by historical parables, the early development of its traditional ideas. The innate virtue of its pure principles is unharmed by legendary or dogmatic absurdities.

The Chinese have an immense antiquity. They are a peculiar people, very marked in their features, and have multiplied so that at present their population and area of production are so balanced that any marked increase would precipitate a famine, and thus equalize conditions. They not only practice economy, but enjoy it, having learned in centuries to live upon the minimum and enjoy the maximum of life.

All other civilizations and emigrations throughout Asia appear to have moved from Asia Minor, and the high central portions of the North and West. The Chinese appear as an isolated people, and have long preserved the peculiar type of a race wholly unlike any other on the continent of Asia. Their country is situated upon the south-eastern extremity of the continent, and hemmed in on the west and north by a chain of mountains practically impassable, and now made more so by the great wall, 1,250 miles in length, with which, B. C. 220, they sought to complete their isolation.

If this people did not develop from the soil they now occupy, we must search for the most probable mode of access by which their earliest ancestry reached their present home. In this stage of the world, all nations are more or less composite.

The southern and south-eastern portions of China border upon the ocean, and if the earliest Chinese came from an opposite direction they must have reached their country by water. If so, it may account for their skilled boatmen, who have lived upon the water from time immemorial, and for the enormous fleets of junks, generally of large dimensions, which they possess. A taste early cultivated may have come down through many centuries.

If we first seek for testimony from Chinese records, we find they ascribe their own origin to the southern portion of China. In order to ascertain how they could have reached there by sea, and the direction whence they probably came, we must study natural causes, and seek among winds and currents for the first natural distributing agents, whose influence on navigation has been but recently overcome by clipper ships and steamers of modern construction.

The Pacific is a wide ocean to cross, and fair winds must have been relied upon, for muscles could never have paddled a direct course for such a distance. Where, therefore, is the country, from which they could follow a fair, fixed wind in a straight course, and be brought to land upon the southern coast of China, where they claim to have originated?

We find in the South Pacific, between the southern tropics and the equator, a perpetual trade wind blowing from the south-east. Towards the tropics, it blows more nearly from the south, hauling gradually into the eastward as it approaches the equator. This constant breeze would drive a vessel kept before the wind, from a point anywhere on the coast of Peru, about in the neighborhood of the Chin-cha Islands, by a slightly curved but almost direct line as far as the equator in the direct course for the coast of China.

In the North Pacific Ocean, between the tropics and equator, the north-east trade wind exists, as the almost complementary counterpart of winds in the southern hemisphere, likewise blowing more northerly near its northern limit, and uniting in an almost due easterly wind near the equator. Thus the south-east and north-east trade winds meet, and frequently blow into each other along a parallel line, making a continuous fair wind, uniting them at the equator, and consequently forming an uninterrupted motive power, to their western limit.

Now, if a large junk were started from the coast of Peru, near Central America, and kept off before these fair winds, there is a strong probability that in sixty days she would strike the southern coast of China, about where early Chinese traditions place the origin of their race. This evidence, of natural causes, apparently points to Peru as the possible home of the Chinese ancestral race. What has Peru to offer in support of such an hypothesis?

In Heaviside's "American Antiquities," published in 1868, we find that "some of the western tribes of Brazil are so like the Chinese in feature as to be almost identical." There is thus a *possibility* shown, that the ancestry of China may have embarked in large vessels as emigrants, perhaps from the vicinity of the Chincha Islands; or proceeded with a large fleet, like the early Chinese expedition against Japan, or that of Julius Cæsar against Britain, or the Welsh Prince Madog and his party—who sailed from Ireland, and landed in America A. D. 1170, and, in like manner, in the dateless antecedure of history, crossed from the neighborhood of Peru to the country now known

to us as China. The very name, Chin*cha*, has a Chinese sound, and reads China, with two letters dropped.

For upwards of twenty centuries, Chinese junks are known to have been large, fast, and strong; their people skillful mariners, excellent carpenters, and marine architects. They early possessed the mechanical skill to build junks of comparatively great tonnage, capable of conveying large amounts of cargo and great numbers of passengers. If the measurements of Noah's ark are correctly interpreted, she was larger than any ship of our day. Ship-building, as we have shown in a previous paper, is a very ancient art, known long before the days of Tarshish. We have no history of its absolute inception. Monuments on land endure to perpetuate the memory of a race, but ships are of their nature perishable. A race that could build the magnificent temples and pyramids of Palenque and Copan, in Yucatan, could certainly have their fleets upon the Pacific Ocean, in ages long before any existing record. The construction of a Peruvian or Central American fleet of large vessels, in early ages, capable of transferring to China, if not 100,000 people, certainly quite sufficient to establish a colony, would require far less skill or enterprise, than that which raised the pyramids of either Central America or Egypt.

China had bronzes in perfection during her very earliest ages, and may have introduced them into Western Europe and Asia. Among the most ancient relics found in Peru, are bronze and iron implements. Many Peruvian and Central American antiquities resemble, not modern Chinese, but their most ancient writings and figures. It is not impossible that Cadmus' alphabet, as well as the hieroglyphics of Egypt, may have been suggested and developed from the ancient American hieroglyphics now coming to light, showing such similarity and apparent connection, and which many scholars already consider as the early models, not the results, of Egyptian figures and Chinese ideographic characters.

The Toltec race in America had a god with one arm—so had the Egyptians. The deified Fo—whom they represent with two small horns, similar to those associated with figures of Moses, the Hebrew lawgiver—instructed Chib-ca Indians in Bogota to paint the cross and trigrams used on their inscriptions; and in China, the Chinese historians ascribe to Fohi many new things, among others, how to paint identical figures of trigrams, like those found among the ruins of Central America. With time and perseverance, it may yet be discovered that a knowledge of hieroglyphics came from Peru or Central America to China—a people whose growing commercial intercourse may have spread their knowledge to the ancient monarchies of Egypt.

The recital of facts may be greatly extended, showing a wonderful chain of evidence, which it is hard to conceive can be entirely accidental and coincidental, unless we take the extremely broad and apparently untenable ground, boldly asserting that primitive humanity, through the action of common laws and natural forces, wherever placed, evolves like forms, customs and necessary results, irrespective of variable conditions and individual fancy or free will. Chinese ideas concerning the Tchin, or original eight persons of a supernatural nature who escaped from the sea, point to an origin from beyond seas, or to an early piscatorial age. B. C. 3,588, Tai-ko-Fokee, a king of China from abroad, was deified. China has her ancient pictorial writings.

Fernando Montesino, a Spanish historian, who visited Peru and published his work from 1508 to 1547, says Peru was thickly populated, and had a catalogue of 101 monarchs, with notes of the memorable events of their reign, extending to B. C. 2,655.

Hawks, in his Peruvian antiquities, says that before the Spanish conquest, in the most eminent period of the dynasty of the Incas, the vast empire of Peru contained eleven million inhabitants, which rapidly diminished, until the census of 1580 shows but 8,280,000, and now the valleys of the Peruvian coast contain barely a fifth of what they contained under the Incas. The total present population by census of 1875 amounts to only 2,720,735 souls. A light native is still called a *China-Chola.*

The feast of souls practiced in Central America appears to have been derived from the same source as that of the ancient Egyptians. The Jesuits of the Propaganda report these ceremonies as anciently in practice in China. The ruins of ancient temples found in Central America resemble in form, space, and massive walls, *without roof*, the most ancient temples of Egypt, and many of the carvings are singularly alike.

Traditionary histories among the different groups of the Polynesian Islands indicate that the Hawaiian race came there from the south. The Hawaiian Islands are nearly in the direct line from Peru to China.

While the majority of Hawaiians are probably descended from Malays, their early traditions tell us of the landing of men belonging to a race whiter than their own, upon the southern island of Hawaii, many centuries ago, whom they were at first inclined to consider as gods, but who finally settled among them, and from their wisdom were elevated to high positions. These men undoubtedly came from Central America or Peru, and may have been from the ancient Peruvian empire, or the later kingdom of the Incas, or from that early civilization whose traces yet remain in Yucatan.

It has been sufficiently demonstrated that even frail canoes and boats, either by accident or design, have performed voyages across wide oceans. In 1819, Kotsebue found at Radack group four natives of the Caroline Islands, who had been driven eastward in a canoe 1,500 miles. In 1849 men came from Honolulu to San Francisco, 2,300 miles, in whale boats. And more recently the boisterous Atlantic ocean has been crossed from New York to Liverpool by a solitary man in a dory.

A dozen of the crew of the clipper ship "*Golden Light,*" burned in the South Pacific about 1865, just west of Cape Horn, reached Hawaii in eighty-one days, in a whale boat under sail, and would have run upon the reef at Laopahoihoi, but for natives who swam off to rescue these exhausted people, all of whom survived.

While we have cited facts showing it reasonable to suppose that early Peruvians or Central Americans may have come to China, by the aid of continuous fair winds, it is no less necessary to show the almost insurmountable difficulties which exist during a greater part of the year to impede their return by sea. To beat back against strong trade-winds and the long regular seas of the Pacific, would be a task in which they would surpass our best modern clippers, which now can only make the voyage by running far north and crossing from Japan to the coast of California, upon the arc of a great circle,

and sailing thence southerly, close hauled on the wind, to the neighborhood of Tahiti in the South Pacific, which must then be crossed in an easterly direction, south of the trade winds, which in turn enable them to make northing and reach the coast of Peru. Such a return voyage would require the most skillful knowledge of winds, coasts, and scientific navigation, such as we have only possessed in comparatively recent times, and would also require exceedingly strong and weatherly vessels. There seems, therefore, less likelihood that any Chinese ever reached Peru in pre-historic times by such a route.

Intercourse appears to have existed more recently, but how far it was reciprocal remains to be seen. If it was commercial it was more likely to have been, as reciprocity is the foundation of trade.

In our search for objections to the theory we are exploring we however, find other possible channels of return communication. During the southwest monsoon a fleet of junks might possibly have left China and followed the Kuro-Shiwo, or warm stream that flows along the coast of Japan, with summer winds across to the northwestern coast of America, near our own harbor, and thence gradually have worked its way southward to Central America, keeping along in sight of the coast until it reached the calm belt around Panama. The Abbé Brasseur de Bourbourg makes this statement: "There was a constant tradition among the people who dwelt on the Pacific ocean, that people from distant nations beyond the Pacific formerly came to trade at the ports of *Coatulco* and *Pechugui*, which belonged to the kingdom of Tehuantepec, in Central America. Baldwin tells us, in his "Pre-historic Times," that "the traditions of Peru told of a people who came to that country by sea, and landed on the Pacific Coast. These may have been from the great maritime empire of the Malays, whose dialects have permeated almost every island in the Pacific oceans. Lang says: "South Sea Islanders exhibit indubitable evidences of an Asiatic origin."

The continent of Asia affords more facilities for reaching Polynesia than America, although stragglers from the latter have doubtless added to its island races, and thus created a mixture of customs which, to some extent, may indicate a partial derivation from both. Probabilities favor Asia, both from certain affinities of tongue, striking resemblance in manners, idols, and physical formation.

Commercial intercourse, although not direct, existed and was maintained between China and Egypt, B. C. 2000. Chinese traditions claim for their people the first use in Asia, of ships and the earliest knowledge of navigation and astronomy. Their people first acquired the mariner's compass and believed the sacred magnetic influence proceeded from Heaven, which they located in the South, and from which they claimed to have come. To this day the heads of Chinese compasses point south.

In Peru, the oldest civilization was the most advanced, and had the highest style of art and mechanical skill. "Her people had an accurate measure of the solar year; a knowledge of the art of writing; and made paper of hemp or banana leaves B. C. 1800." The aboriginal Peruvians have had their dark, as well as bright, ages in history. They may have retrograded while their possible offshoot, the Chinese, progressed. Young colonies often grow and prosper, while their progenitors reach a climax and die out. Dis-

solution is the countercharge, which every material aggregate evolved, sooner or later undergoes. Evolution and dissolution bring to us ever changing, but eternally advancing forms, in their cycles of transformation.

The establishment of a race may be possible from a single pair, of strongly marked distinctive characteristics, whose descendants have continually intermarried. Hebrew patriarchs founded nations, and nations thus springing from a single man of pronounced character, whose descendants remained united and isolated, have often developed strong and peculiar personal characteristics, which have pervaded and stamped themselves upon the race thus descended. Mixed or cosmopolitan races, never possess uniform characteristics as clearly defined.

It seems more reasonable to infer, that a fleet from the neighborhood of Peru may have reached China with the first emigration, perhaps bearing a hero-sovereign and an invading army, which, once landed, found China agreeable, and, being unable to return against those perpetual winds which brought them so swiftly, were compelled to establish themselves in new territory.

Writers on Central America have expressed a decided opinion, that the peculiar character of its ancient civilization, manners, customs, and general structure of the ancient language, point very strongly to a common origin between the Indo-Chinese nations of Eastern Asia and the ancient civilization of America, which appears, in some remarkable particulars, to have been of an Egyptian cast. The Coptic or ancient Egyptian language, however, seems to have been monosyllabic. Hieroglyphic writing is of three kinds: figurative, symbolical and phonetic. Hubert H. Bancroft, in his Native Races of the Pacific States, Vol. V, f. 39, says: "Analogies have been or thought to exist between the languages of several of the American tribes and that of the Chinese. But it is to Mexico, Central America, and, as we shall hereafter see, to Peru, that we must look for these linguistic affinities, and not to the northwestern coasts [of America], where we should naturally expect to find them most evident." Count Stolberg, quoted by Humboldt, is of the opinion that the Peruvian cult is that of Vishnu—one of the Brahmin trinity—when he appears in the form of Krishna, or the Sun.

Mexican kings, who reigned previous to the Spanish conquest, all added TZIN to their names as a reverential affix. It resembles in sound a dynasty of China—the Tsin dynasty—which reigned from B. C. 249 to B. C. 205. Tai Ko Foki, the Great Stranger King of China B. C. 3588, or later Hoang Tai, may have landed from such a fleet, and been called by conquest, or through the reverence of superior knowledge, to reign over them. The descendants of these early settlers may have remained clannish, keeping apart, as an entirely distinctive race, from the Miauts or original aborigines, naturally following the customs of their forefathers, and thus have increased and grown into a mighty nation, unlike all people around them.

During many centuries of growth, China, like Japan and Corea, became a sealed empire, when no possible admixture of foreign blood could occur. It seems to have become an established habit with these nations to periodically close their ports to foreign intercourse. Some similarities of race exist between some types of the Coreans and Japanese, while the Chinese are

quite singular and unlike. Their oriental peculiarities, which strike the casual observer, are their dress, shaved heads and queues, habits, odor, and guttural language. Chinese are the only nation on the continent of Asia that use chairs and tables. Isolated nations, like hermits, cannot escape being distinguished by eccentric habits. Now, if the high civilization of Peru, which was in full tide B. C. 1800, and probably many centuries before, crossed to China in very early days, bringing its accurate measure of the solar year, and the arts of making paper and writing, all the necessary material was furnished China for the production of correct and reliable historic records. In reviewing Chinese early history, we have found that, B. C., Tai Ko Foki, their Great Stranger King, introduced a knowledge of these things, with hieroglyphic characters, and first divided time for them into lunar months and solar years. And we have shown that the authentic comprehensible history of China begins with his reign.

Now we inquire, did Foki, with all this valuable knowledge, come from Peru B. C. 3588, and settle among a pre-existing people, perhaps similar to, if not the aboriginal Miautz, long since driven from the plains of China into the almost inaccessible fastnesses of its mountain barriers?

A knowledge of days already existed among the sun-worshipers of Asia, who doubtless kept their records in days; but the introduction of a scale measuring by months and years placed their history on a footing we can comprehend; and the introduction of the art of writing enabled them to perpetuate it by enduring records. When we discover the measures of time, used to gauge ancient histories before these improvements were introduced, we shall doubtless find their records reasonably authentic. We have as little understood their stupendous figures as strangers conceive the value of a Brazilian rea, some 1000 of which, make a sum equal to the United States dollar; and accounts involving such currency bear the formidable aspect of immense sums, to the uninformed. With advancing centuries, the measure of time doubtless lengthens.

After the children of Israel left Egypt, where the solar year was known, records of extreme longevity disappear, and ordinary terms of life are adhered to. We should judge cautiously, and refrain from any interpretation at variance with human reason and common sense. The lunar changes, without doubt, were employed in the measurement of time in all warm climates before the introduction of the solar year. The colder the winter, the more marked the year became as a measure of time. Day and night would naturally suggest themselves as the first measure. Peruvians, Chinese, Egyptians, Hebrews, Japanese, Polynesians, and others, all attribute great longevity to their earliest ancestry, until the introduction of higher mathematics and the solar year.

The oldest histories preserved to us become what in our day we call authentic, when their nations acquired the art of writing, and divided time in a regular and uniform manner, by the solar year.

The first and fabulous epochs of most histories begin with dynasties of deified warriors. The tendency to deification exists among all early nations, and we need not go out of our own history to prove it. Edmond the Confessor, the Archbishop of Canterbury, who died as late as 1242, was canonized as a

saint, only a differentiated form of the same tendency. The gods of antiquity were partly impersonifications of natural forces, and partly deified men. They often bear the same relation to facts that shadows do to forms, being at worst but simple distortions of the truth. Few nations can examine impartially the substratum of their ancestral religious creeds. How often do we find in dogmatic theology the imprint of early paganism? The Hawaiian nation is supposed to have a considerable antiquity. From time immemorial there have been persons appointed by the government to preserve, unimpaired, the geneology of their kings, which in 1863 embraced the names of more than seventy. Allow an average reign of twenty-five years, this would throw their history back 1,750 years, to A. D. 117 or earlier, say to about the Christian era.

It was a custom throughout the islands of the Pacific to exterminate their enemies, either by killing or setting them adrift in canoes. The latter practice not only led to the peopling of the various Polynesian islands, but was also a cause which led to cannibalism, for want compelled the exiles to subsist on each other, and a taste once indulged in, was continued by survivors who succeedeed in reaching some island, and thus cannibalism became established. North American Indians have never been cannibals.

When Spaniards first visited America, the western equatorial regions of the continent were the seats of extensive, flourishing and powerful empires, whose inhabitants were well acquainted with the science of government, and had evinced considerable progress in art. Roads fifteen hundred miles long, remain in Peru, relics of the past, as ancient as the Appian way. In very remote times social etiquette was observed and universally respected. The early Peruvians constructed suspension bridges across frightful ravines, and moved blocks of stone as huge as the Sphinxes and Memnons of Egypt. They built aqueducts of baked clay and constructed dykes and causeways, and preserved a memory of past events by picture writing. They had a language of ceremony or deference, with reverential nouns and verbs, with which inferiors addressed superiors, a feature of resemblance to the Chinese in Eastern Asia.

Ruins of extensive cities and fortifications are now found in Yucatan and regions of Central America; the elevated plains of Bogota and *Cundinamarca;* the open valleys of Peru; and the lofty, secluded and highly fertile tracts of Chili. These colossal remains of ancient primitive civilizations are passing from the memory of a degenerate offspring, who now behold with indolent amazement these interesting relics of their illustrious predecessors. The origin, history and fate of these powerful nations of America, who have left behind them such colossal memorials of an ancient civilization, is a study of profound interest. Stones, thirty by eighteen by six feet, are squared and hewn and reared with utmost exactness. Their style of arch is peculiar. Temples, pyramids, tumuli, and fortifications, with remains of buildings of singularly massive architecture, often exquisitely carved, betokens a civilized antiquity.

It seems impossible that these people should have passed from the continent of Asia by Behring's Straits, for no traces of any such people remain anywhere along that route.

Pyramids of remote antiquity are found in India, China and Tahiti, as well as in Egypt and South America. Those of Egypt are in the best state of preservation and perhaps therefore the most recent.

The learned Bavarian, Dr. Von Martius, regards the evidence incontrovertible "of the existence of the *aborigines of America* long anterior to the period assigned in Hebrew chronology for the creation of the world;" a race whose utter dissolution manifests that it either bore within itself the germ of extinction or attempted an existence under most fatally unfavorable conditions.

Dr. Clarke says: "No race of human kind has yet obtained a permanent foothold upon the American continent. The Asiatics trace back their life in Asia so far, that the distance between to-day and their recorded starting-point seems like a geologic epoch. The descendants of the Ptolemies still cultivate the banks of the Nile. The race that peopled Northern Europe when Greece and Rome were young, not only retains its ancient place and power, but makes itself felt and heard throughout the world. On the American continent, races have been born, developed, and disappeared. The causes of their disappearance are undiscovered. We only know that they are gone." It remains to be seen if the Anglo-Saxon race, which has ventured upon a continent which has proved the tomb of antecedent races, can produce a physique capable of meeting successfully, and advancing under, the demands that our climate and type of civilization make upon it. This is an interesting query.

If we have been utterly confounded in contemplating the stupendous monuments of Egyptian magnificence, which continue to defy the ravages of time, what shall be said of remains of more ancient pyramids and colossal figures in America, of a style and character analogous to those of ancient Egypt, whose very stones are crumbling to decay, and on whose flinty sides verdure has crept over the dust of ages, until ancient and gigantic forests have acquired root-hold, and grown over their very summits? Many an Alexander and Napoleon of pre-historic times has gone to his rest, and left no record, capable of enduring to the age we live in, to mark the glory of his empire. Many mummies are found in Peru, enveloped in bandages of fine cloth, while the bodies of kings are admirably preserved by means of a secret known only to the royal family.

In the far distance of remote antiquity, successive peoples have risen to importance and passed away, long ages before the birth of those from whom the faintest ray of civilization has remained to cast even a feeble reflection of its pale light upon the fading pages of our most ancient historic records.

A period has undoubtedly existed, in the primitive history of our earth, when the necessary equilibrium between its external and internal forces has been lost. When the external pressure on the crust became diminished by the sublimation and recomposition of external elements, which, when refined and advanced, were unequal in density to the expansive force of igneous materials confined in the interior mass. The solid enveloping crust of our sphere is the medium constantly acted upon, by these contending forces, in seeking a state of equilibrium. Geologists direct us to many prominences in which the upheaved strata, on one side, is abruptly broken, and on the other, gently inclined. Such ruptures could not have been gradual, for in places the whole combined strata is fractured, depressing portions, and rais-

ing others to immense heights. Earth's surface, to-day, bears unmistakable evidence, to every thoughtful student, that eruptive catastrophes have materially changed its geological features—especially the levels. Many areas, formerly submerged, are now dry, and known as alluvial formations. Seas have changed position, and rivers acquired new courses. New land has been formed, and mountain ranges reared by upheaval. Recent deep-sea soundings of the U. S. steamer *Tuscarora*—commander, Belknap—clearly illustrate how largely the bed of the Pacific Ocean—once but an extended valley, running, perhaps, from the Arctic to the Caribbean Sea—may have augmented its area by a comparatively moderate depression. During the glacial period, immense icebergs were produced at the poles, and as they increased in bulk, during a succession of cold winters, they accumulated an enormous volume of water—human life is considered to have been extant at this period—and when a succession of warm summers, produced by the perpendicularity of the earth's axis to the plane of the ecliptic, succeeded in reducing these huge accumulations of polar ice, its volume retired, covering many valleys not previously submerged. This could have given rise to the legend of a Flood, which may have occurred, but could not have been universal, for a sufficient amount of water does not exist to cover the highest mountains, and submerge the entire earth.

A sudden and eruptive convulsion of earth's crust during the tertiary, near the close of the cretaceous period, whether separate or conjointly with a flood, must necessarily have destroyed a large majority of partially developed men, struggling to evolve the higher human types. Portions of Asia, Africa, and Australia are supposed to have been elevated; while Europe, the extreme northern portions of America, the Caribbean Sea, and the beds of certain oceans were depressed. The effects must have been most forcible around the poles and south of the equator. Dead river beds which cross the highest mountain ranges of the Pacific Coast, and yield so largely of gold to hydraulic washing, clearly confirm radical changes in the physical conditions and levels of this coast.

The surviving remnants of these catastrophes, in Asia, Africa, Yucatan, and a few scattering tribes of North America, thenceforth appear as the progenitors of all living nations. It is only from this period that we can hope to trace the early history of humanity. Previous beings, if in harmony with physical conditions, must have been generally in the incipient stages of human evolution. In Central America alone, we find ruins, whose hoary antiquity seem to claim for its inhabitants the earliest civilization of which any traces remain. It is fair to infer that the pyramids of Yucatan were antediluvian and escaped inundation, as did the cities of Palenque and Copan. These elaborately constructed cities of Central America exhibit conceptions of beauty which, as early specimens of a gradually unfolding art, appear to antedate all similar structures extant.

Plausible grounds of inference exist, that the earliest manifestations of culture known to us, was among the primitive settlers of Central America, who, having acquired mechanical invention, art, and the rudiments of science.

built dwellings and temples, which yet endure as testimony of their progress. Although their minds were doubtless uncultivated in those higher branches of knowledge and refinement which ensures perpetuity to national life, they seem to have led the world in the early use of language, and the adoption of picture-writing to record and communicate ideas.

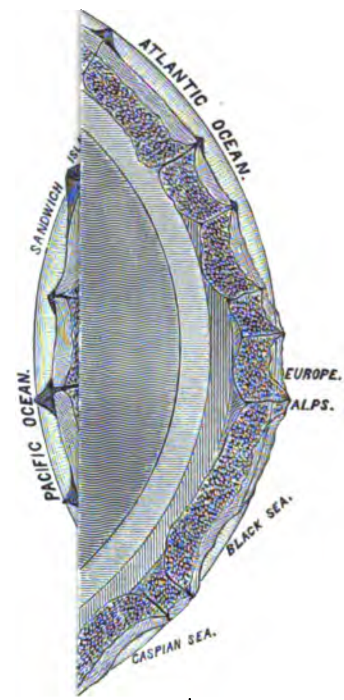
The sun, which was long the national emblem of Central American nations, is the absolute basis of mythology. It seems probable that Yucatan once extended over the present bed of the Gulf of Mexico, including the West Indian Islands. The Caribs may be a degenerate remnant of some aboriginal race. The ancestors of our North American Indians were very uncultivated in their physical, mental and social condition.

Long before Egypt, the progenitor of Greece and Europe, was settled, the inhabitants of Yucatan appear by their monuments to have been well advanced in general intellectual attainments, and to have led all known nations in art and science. Why may not a branch of this people have emigrated to China and Egypt, and there have become a large and advanced nation ?

Many things unite to prove that China, at the opening of her treaty ports to European trade, was unmistakably retrograding in the physical as well as social organization of her people. Her highest prosperity is thought to have been reached about the reign of Genghis khan.

Agassiz tells us that, geologically considered, America is the oldest continent. If so, why should we not look to it, as the spot where the human race first gained ascendancy, and acquired its primeval home? If its primitive races have died out, and stone pyramids crumbled beneath the dust, is it not a strong argument in favor of her antiquity? In Asia, traces yet remain of original races, whose earlier civilization in America, under different physical conditions, *has had time* to culminate, dissolve, and *fade from sight*. When, in the early development of America, progress was sufficient to facilitate emigration, why may she not have furnished population to Asia? In submitting this question, with evidence calculated to warrant further study, and outlining various channels for investigation, we aim to attract for it that scientific attention which, as an ethnological problem, it fairly deserves, hoping some satisfactory answer may be attempted, before facilities for interrogation yet available among American aborigines, shall have passed away forever.

This imperfect collection of facts is laid before the Academy in its present condition, not in any way to ask for present endorsement, but to awaken new sources of inquiry among thoughtful ethnologists, which may ultimately lead to a discovery of the truth. A large mass of additional facts bearing upon this subject require more labor than I have yet found time to bestow, and would also unreasonably swell this already lengthy paper, which is offered as a simple inquiry, suggested to careful and technical scientists, who, by comparing physical, embryological, and linguistic characteristics, pertinent histories, and traditions, may in future establish or disprove the possibilities here shadowed forth.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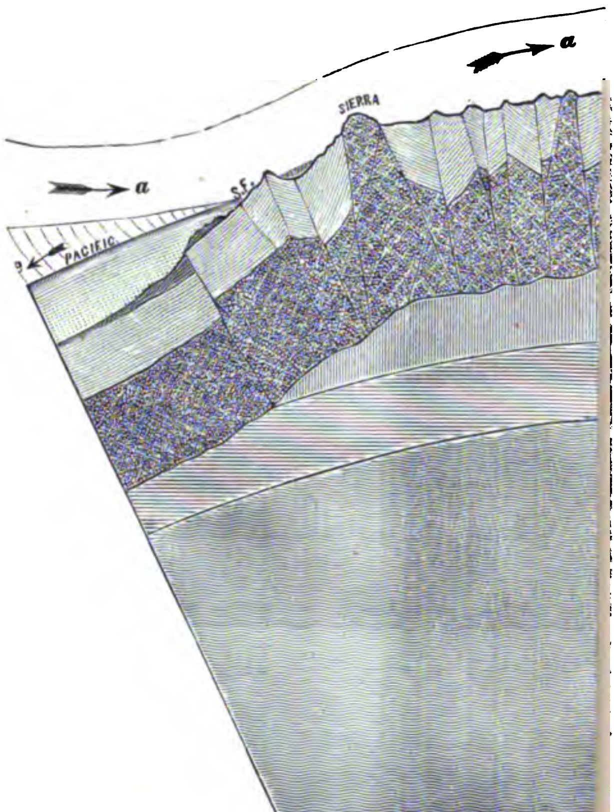

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IDEAL SECTION OF NORTH A

REGULAR MEETING, MAY 17, 1875.

Vice-President Edwards in the Chair.

ty members present.

istave Mahé and Ernest L. Hueber were elected resident bers.

seph L. King and Pembroke Murray were proposed for bership.

onations to Museum: Sponges and tertiary fossils from San go, by Henry Hemphill; concrete gum, from C. B. Smith; il from Mazatlan, and Epiphites (Abies Douglassii), Henry wards; fragments of wood from a well 180 feet deep in Alvarado, meda County, California, from John Hall; Indian Mortar, m Amos Bowman; fine specimen of peacock (mounted), from nes Lick; portion of skull of *Ursus horribilis*, from M. Hara; snake from Master Willie Lockington.

Wm. Guerin read a paper on "The Sewage System of San ancisco."

Mr. Stearns read a paper by J. E. Clayton, of Salt Lake, as llows:

The Glacial Period—Its Origin and Development.

BY J. E. CLAYTON.

In the summer of 1860, I discovered the markings and terminal moraines f the Glacial system of the Sierra Nevada mountains, on the head waters of he Merced and Tuolumne rivers.

Upon my return to San Francisco, I reported the facts to the California Academy of Sciences. Since that time I have been a careful student of the glacial phenomena presented on the western slope of the continent. In other portions of the world, the phenomena of the Glacial period have engaged the attention of scientific investigators, ever since geology became a science.

Many theories have been suggested to account for the sudden change of the climate of our planet, at the close of the tertiary age, from temperate and tropical heat to that of arctic cold. The theories put forth by the ablest

writers on the subject have failed to account, satisfactorily to my mind, for the most important facts observed. Many of these theories are based upon an assumption of conditions and causes that cannot be maintained by logical deductions from the general laws governing the progressive development of the planet.

I will review briefly some of the theories put forth by eminent scientists, by which they attempt to account for the great changes in the climate at the close of the tertiary age.

THE FIRST THEORY

Is, that there occurred a great upheaval of land in the Northern Hemisphere, by which the currents of the ocean and of the atmosphere were greatly changed or modified, and that this great elevation above the ocean level was the primary cause of the change of temperature. This line of reasoning appears to me untenable, for the following reasons: 1st. If the elevation of the land surface had of itself sufficient influence on the climate to produce the Glacial epoch, it ought by the same law to have continued that condition until the present time, and to an indefinite period into the future ages. As this supposed cause has not been sufficiently potent to continue glacial conditions, it therefore follows that it was not the primary cause of climatic changes, but was merely a modifying influence, in so far as it changed to a limited extent the direction of the air currents.

2d. The thermal effect of the sun's rays upon land surfaces is much greater than upon water surfaces. Hence the atmosphere becomes heated by its contact with the land even at great altitudes. The land surface of the North American continent will probably not exceed an average altitude above sea level of more than two thousand feet. Compare this altitude with the different heating power of the sun's rays upon land and water, and the change would in all probability be an increase of atmospheric temperatures.

3d. The effects of the elevation of the continents would be to largely increase the land surfaces, and correspondingly decrease the areas covered by water. The interior basins or inland seas would be drained off, the watersheds steepened, so that the surplus rainfall would be rapidly drained into narrow, swift-running streams, thus reducing the sources of vapor to very narrow limits as compared with the water surfaces in the beginning of the tertiary age. It therefore follows that a largely decreased evaporating surface, and a correspondingly increased thermal effect of the sun's heat, could not supply the conditions for a continental glacier system. Hence I conclude that the elevation of land surface in the Northern Hemisphere was not an adequate or primary cause of the Ice period.

SECOND THEORY.

Some investigators suppose that, by some means, the relative positions of the poles of the earth have been changed, so as to bring the then frozen zone into the range of the now temperate and tropical latitudes. As a proof of this, they cite the facts that the remains of vegetable and animal life, that are

now peculiar to the tropics, are found in abundance in the polar regions of our time. By what means a self-balanced rotating globe could change the position of its mass, without changing its line of rotation, is not shown by the advocates of the theory; and unless the cause of such change can be clearly shown by facts that cannot be accounted for in any other way, the theory cannot be accepted as even probable.

If the general proposition is true, that the earth was originally incandescent, and has been slowly cooling through past ages by radiation, it follows that the conditions for tropical life must have begun near the poles, and progressed toward the tropical zone, in harmony with the changes of climate. If no violent disturbances of level had taken place, the change would have been slow and almost imperceptible; but we know that violent changes in the earth's crust have taken place, and have produced rapid if not sudden changes in the temperatures and climates of its surface. These changes have been sufficiently violent to destroy the characteristic types of life existing at the time, and mark a distinct period in the progress of the globe toward its present condition. I therefore conclude that the theory of a change of the poles of the earth is not susceptible of proof, and therefore unworthy of serious consideration.

THIRD THEORY.

Another class of investigators, failing to apprehend the true causes which produced the Ice period, have proposed the theory that the solar system, in its sweeping circle through space, has encountered or passed through frigid zones in the stellar spaces that reduced the surface or atmospheric temperature to an extent sufficient to give an Ice period to our climate.

This theory, like the one above considered, has not been proved by any well considered facts, neither is it susceptible of proof by any known means within reach of human investigators. If this theory were true, the waters of the globe would have been frozen where they now are, and could not have been transferred to any considerable extent, by evaporation and condensation, upon the land surfaces.

The extinction of life would have been a slow, starving and "freezing out" process, that could in no reasonable way account for the facts of glacial times. The conclusion therefore follows, that cosmical influences had nothing to do directly, in producing the Glacial epoch at the close of the tertiary age. The facts, so far as I have been able to trace them out, all seem to indicate that the geological disturbances and volcanic eruptions that occurred at the close of the tertiary age, together with the return trade winds, were the only causes, ample and sufficient to produce the facts and phenomena of glacial times.

The question then may be asked here: What are the conditions necessary to produce a glacial period? The answer is plain and simple: 1st. A folding and dislocation of the earth's crust along great longitudinal lines (N.-S.) along the western borders of one or more continents. 2d. The issue of interior heat, followed by great outflows of lava along such lines of fracture. 3d. The local vaporization of the waters of the surface by contact with the lava

outflows and other points of escaping heat. 4th. The ascent of the vapors to a height sufficient to penetrate the return trade winds, or upper currents of the atmosphere. 5th. The general depression of the ocean beds, and corresponding elevation of the continents, and development of the great mountain chains of the globe.

That such conditions and facts did occur at the close of the tertiary age, substantially in the order named, is well known to every practical student of Geology. That such conditions and facts, in conjunction with the upper currents of the atmosphere, were ample of themselves to produce and would of necessity cause the glacial epoch, cannot, in my opinion, be seriously questioned.

To bring this subject clearly before the mind, it will be necessary to make a brief survey of the physical geography of the continents during the tertiary age. The geological records, so far as science has been able to trace them out and interpret their true meaning, show that, in the beginning of the tertiary age, the continents over their largest areas presented low, undulating surfaces, but slightly raised above the ocean level; that large districts were covered by fresh-water lakes and inland seas, some of them at one period presenting the forms of life peculiar to marine and brackish waters, and at other periods only such living forms as are known to exist in fresh water—thus proving that slight oscillations of the earth's surface were sufficient to cause the oceans to invade some of the interior basins of the continents and fill them with salt water. Hence, in many of the tertiary formations, we have presented the various forms of life peculiar to marine, brackish, and fresh waters. During the progress of the tertiary times, great changes of level were produced over large continental areas, until they became mostly dry land. In the later tertiary period, the marine deposits were gradually confined to the low borders of the continents, and the interior basins became filled exclusively with fresh water, and only fresh-water deposits were formed in their beds.

The climate of tertiary times fluctuated from a tropical warmth, that was well nigh universal over the globe at the beginning, to temperate and even Arctic cold in the higher latitudes, where great elevations of mountain chains occurred in the later periods. At the close of the tertiary age, the disturbances of the solid crust of the earth were enormous. Great mountain chains were elevated on all the continents, accompanied with corresponding depressions of the ocean beds, thus confining the oceans to narrower limits and increasing the land surfaces above the waters.

This last grand change of land and ocean levels must have occurred mainly by sudden convulsions and re-adjustments of the earth's crust. The continued radiation of heat from the fluid nucleus of the globe caused its continued shrinkage. The consolidated crust conformed to this shrinkage by corrugations and oscillations of level. The sinking down of the ocean beds and elevation of the continents went on slowly through the long periods of the tertiary age, until the lateral pressure of the earth's crust became so great that it culminated in a series of dislocations and uplifts over all the continents of the globe. The ocean beds were doubtless equally disturbed and broken, so as to relieve the lateral pressure caused by the shrinkage of the interior.

The immediate effect of this relief of lateral pressure would be the settling down of the broken, folded, and dislocated crust with nearly its full weight upon the molten mass of the interior. This would cause the outflows of lavas through the broken lines, until the fluid and solid portions of the globe were balanced according to their relative densities and weights, just as water will ascend in the fissures of broken ice to the points of equal weight. It would appear from this line of reasoning, that the greatest outflows of lava ought to have occurred where the greatest downward folding took place; and this is strongly indicated, if not proved, by the islands of the oceans being nearly all of volcanic origin, and the lower flanks and plateaus of the continents having the greatest lava outflows.

While we must admit that the changes of level over large areas of the globe were very slow, and extended through long geological periods, we are still forced to the conclusion that sudden changes of vast extent have taken place at the close of the principal eras. These convulsive movements not only changed the relative positions of the land and ocean levels, but also swept away all living forms peculiar to the geological age that was terminated by such changes. The general results following such violent terminations of geological ages would be—

1st. The escape of enormous quantities of interior heat, accompanied by great lava outflows along all the principal lines of disturbance.

2d. The consequent vaporization of large quantities of water, continued through the period of disturbance, and until the lavas were cooled and all the principal vents of escaping heat were closed. In the earlier geological periods, when the average temperature of the earth and atmosphere was much higher than it is now, the waters vaporized during periods of volcanic or igneous activity would descend in floods of rain; but in later times the general temperature became so much reduced by the radiation of heat, and the crust of the earth had become thickened to such an extent, that the atmospheric temperature was dependent mainly upon the influence of the sun.

Under these conditions, the vaporization of the waters by the outflows of lava and hot gases, at the close of the tertiary age, would give results greatly modified by atmospheric temperature. Near the points of igneous outbreak, the lower zones of vapor would descend in floods of rain; but those portions of the continents lying east of and remote from the lines of volcanic activity would be buried in enormous depths of snow. Prof. Tyndall says, "To produce a glacier, we must first vaporize the waters." I think I have indicated how the waters were vaporized. The next thing to demonstrate is the freezing of the vapors, and their distribution over the continents, especially over those portions remote from active igneous disturbances.

A careful study of the wind currents at this point becomes an essential part of the problem to be solved. The currents of the lower portion of the atmosphere are modified in their movements to a great extent by the mountain ranges and continents, but their general tendency is toward the west, as they approach the equator. The upper currents are more uniform in their movements, and they have a general tendency toward the northeast and southeast, moving spirally from the equator toward the poles, in curves of great length around each hemisphere before the polar regions are reached,

where they curve under and again become the lower currents on their return to the equatorial zone.

If the globe was a perfectly smooth sphere of homogeneous material like water, the atmospheric currents could be mapped out with mathematical accuracy; but the unequal surface of the land and the different thermal effects of land and water surfaces produce great modifications of the wind currents in certain latitudes.

This is especially the case along the west coast of the North American continent, where the polar current swings far out to the westward over the Pacific, and the return trade wind, or upper current proper, swoops down behind it to the east and strikes the west coast, and sweeps northeastward over the continent.

This fact is beautifully and conclusively proved by the trees on all the higher mountains from the Pacific coast to the summits of the Rocky Mountains. The scrubby trees in all exposed positions near the higher summits lean east and northeast; even the small twigs are bent around the limbs and trunk in the same direction, so that the whole aspect of the tree presents the appearance of reaching out to the northeast with every limb and twig. These facts show that the wind does blow in that direction (N. E.) almost constantly. The general fact is well known, and I will not go into tedious details to prove what must be readily admitted by hundreds of careful observers.

At the close of the tertiary age, the western slope of the continent was the principal scene of active volcanic disturbance. To comprehend the fearful extent of this disturbance, and the enormous masses of lava outflows, one must travel over the disturbed regions and see them. My powers of description are too limited to undertake the herculean task. The whole western slope of the continent has been broken, crushed and distorted in every conceivable manner. Districts as large as some of the smaller States have been buried to unknown depths with lava and ashes. Large rivers and great lakes were swept out of existence by the overwhelming catastrophe. The lakes, rivers and oceans sent columns of hissing vapors miles in height into the upper air currents, where they were frozen as they were conveyed eastward, and spread broadcast over the more quiet eastern slope of the continent. Thus the waters of the Pacific coast were vaporized and spread over the continent by the return trade winds. All living things were overwhelmed and buried in the sudden storms of snow. The mastodon and kindred tribes were buried up suddenly, with their stomachs full of food, their bodies loaded with fat, and not a trace of any slow process of change in climate from cosmical or other exterior causes.

It was evidently no slow, starving-out process that destroyed the animals of tertiary times, but the sudden and overwhelming effects of a great geological catastrophe.

While the elephant, rhinoceros, and other large animals were being buried in the ashes and debris near the volcanic outbreaks on the Pacific slope, the same class of animals were being covered hundreds of feet deep in snow on the eastern slope of the continent.

Those animals that were not buried, like Pompeii, in ashes and mud near the outbreaks, were overwhelmed and destroyed by the resistless floods of

rain, and the crashing shocks of the earthquakes The snow and ice period of the northeast was contemporaneous with the flood period of the Pacific coast.

No continental glacial system covered the Pacific portion of the United States, notwithstanding the altitudes were much greater; the glaciers were local, and more or less isolated, clustering around the higher peaks of the mountains.

The valleys and basins of this western volcanic region were filled with hot water, hissing steam, and volcanic products. No ice beds could form in the valleys of the Pacific; the hot rocks and escaping gases were busy, vaporizing the waters for the glacial supply of the east. No gentle snow-flakes could find a resting-place upon the table lands and valleys of the volcanic belt; but floods of rain descended, and plowed deep gorges down the steepened flanks of the recently elevated mountain ranges, thus establishing a new river system for the Pacific coast.

The most prominent examples of this are seen on the western slopes of the Sierra Nevada range, in the State of California, where the old river system has been completely buried, first by ashes and debris, brought down by the floods of water from the vents along the higher portions of the range, and secondly by broad streams of lava extending from such vents, to the plains of the valley. Notable instances occur in Tuolumne, Sierra, and Plumas counties. The portions of the old river system that were covered by the lava outflows were protected by them from subsequent denudation, and are now the summit lines of long ridges that divide the waters of the newly formed river cañons.

Under these immense fields of volcanic ashes and lava beds are found the relics of the tertiary life; and not a trace of such life has been found anywhere existing on the Pacific coast since this period of uplift and volcanic activity which closed the tertiary age.

The next notable changes were the development of the new river system, by the changes of the water-sheds and the enormous floods of water that fell for many years near the lines of escaping heat, and the formation of glaciers on the higher portions of the mountain ranges. In some places the glacial action has been traced down the slopes of the granite peak to the lava beds, and for considerable distances on their upper surfaces, thus showing that as the lavas became cooled, the ice pushed its way over their higher portions.

Here we find events well marked in the order of their occurrence:

1st. An undulating, fertile country, of subtropical or temperate climate, teeming with the living forms of tertiary times.

2d. A violent and sudden outbreak of volcanic activity, accompanied by great changes of level.

3d. The destruction of nearly all life, followed by floods of rain to an extent nowhere possible except near the sources of vaporization.

4th. The formation of glaciers on the higher mountains toward the close of the flood period, and as soon as the local temperature was sufficiently reduced to permit their formation.

These characteristic changes were not confined to the California coast. The line of volcanic activity extended from Cape Horn to Behring Strait. In

fact, the whole western slope of the American continent, from the Pacific shores to the summits of the Andes, Cordilleras, and Rocky Mountains, was in active eruption and volcanic disturbance.

If no other parts of the world had been subjected to like disturbances, the vaporization of the waters along this one great zone would have been sufficient to modify its climate; but other portions of the globe were disturbed to nearly an equal extent. And there can be no doubt about the effects of such enormous evaporation of the waters on the climate of every part of the earth; even tropical countries would be covered with snow if the vapors were sufficiently abundant and dense to exclude the heat of the sun for a series of years. The influence of the trade winds or great general currents of the atmosphere, must not be lost sight of; they were the conveyers and distributors of the vapors produced by the escape of interior heat at the various points of disturbance.

By tracing their general courses from such lines of disturbance, it is easy to determine where the greatest deposits of snow would accumulate and form the continental glaciers.

I have said that nearly all traces of tertiary animal life, were swept from the American continent. But such does not seem to be the case with Africa, India, and a part of Asia; there the elephant, rhinoceros, and many other types of life closely allied to the tertiary mammals, remain.

This important difference in the present types of life of the two hemispheres can be accounted for upon the general basis of the theories advanced in this paper. The course of the return trade winds, or upper currents of the air, is toward the east, but constantly diverging north and south from the equatorial line. The American continent is narrow in the equatorial zone, except a portion of South America.

The great volcanic activity along the Pacific slope overwhelmed the low lands with floods of water of such enormous volume, that nearly all land animals were swept off or buried in the debris from the mountains. There is no doubt but all the highlands of the tropical portion of South America were buried deep in snow, if not with glaciers. Now take the line of the upper air-currents across the Atlantic to the coast of Africa, and you will see that the divergence of these currents north and south will divide the vapors, and leave Africa comparatively free from their effects. The west coast of that continent was but slightly disturbed by volcanic activity, and there was not enough local vaporization along its west coast to give it a glacial system or flood period of sufficient volume to destroy its land animals completely.

The same may be said of portions of Asia and India. Hence the preservation of leading tertiary types in the Eastern Hemisphere, and their almost complete destruction in America, must be attributed to the operation of the atmospheric currents in conveying the vapors away from some portions of the land, while they covered other portions to great depths in snow and ice.

Some geologists assert that many of the tertiary mammals existed in North America after the close of the glacial epoch. This opinion should be received with great caution, for the reason that such remains were preserved in the ice and snow of the glacier period; and as the glacial fields slowly moved down mountain slopes and melted away in later times, the skeletons would be

deposited in lakes and alluvial deposits along rivers, and become so intermingled with the remains of more recent times, as to give them the appearance of being contemporaneous.

By referring to the researches of Agassiz, Forbes, Tyndall, and other eminent investigators of glacial phenomena, it will be seen that they admit the influence of the air-currents in glacier-building.

The great return trade-wind current, that sweeps in a curved line across Northern Africa and the Mediterranean Sea, deposits its accumulated vapors in snow upon the Alps, where the glaciers of the present time have given scientists an opportunity to study their formation and movements, and to trace out, to a limited extent, the causes that produce them.

I must beg the indulgence of the Academy and scientific investigators generally, for the incomplete and somewhat crude style in which this interesting subject has been presented by me; but I must express the hope that it is sufficient to call the attention of abler minds to the broader field it opens up for future investigations, and that it will add a little to the sum of our present knowledge of one of the most interesting periods in the geological history of our planet.

SALT LAKE CITY, February 12th, 1875.

Mr. Stearns and Dr. Blake made some verbal remarks on the subject of the above paper.

The Secretary read an extract from a letter by A. W. Kiddie, County Surveyor of Plumas County, confirming the claim of Dr. Harkness as the rightful discoverer of Lake Harkness.

REGULAR MEETING, JUNE 7TH, 1875.

Vice-President Gibbons in the Chair.

Twenty-five members present.

S. B. Christie and Frank Soulé were elected resident members.

A. W. Crawford, Dr. G. King and Dr. F. W. Godon were proposed as candidates for membership.

Donations to the Museum: From F. Gruber, specimens of green-winged teal and blue-winged teal; from Samuel Purdy, galena and silver ore from Utah, bismuth from same place, and

silver ore from Sonora, Mexico. President Davidson donated seeds of wax tree, copper and pheasant skin from Nagasaki, Japan. J. Begg donated specimens of cones of *Pinus aristatus*. Mr. Graham presented a specimen of "Loco" poison (*Oxytropis campestris*) from Bakersfield, S. P. R. R. From Mr. Zellerbach, quicksilver ore from Lake County. J. P. Moore presented specimens of ore from various localities. J. G. Riley presented specimens of ore from Lake County. Specimen of *Picea religiosa*, from volcano of Colima, Mexico, from J. Roegel. A. J. Dennison presented piece of chestnut or ash wood found embedded in piece of quartz from depth of 230 feet from surface, in Lee mine, Elko County, Nevada, on C. P. R. R., Palisade, 472 miles from San Francisco.

Henry Edwards submitted the following:

Pacific Coast Lepidoptera.—No. 12. On some New Species of Noctuidæ.

BY HENRY EDWARDS.

The species of moths described in this paper belong to the group *Anartidæ*, many interesting forms of which have been recently figured by Mr. Grote, in the Bulletin of the Academy of Sciences of Buffalo. Their extreme rarity in collections has always rendered them a favorite division of the family, and more than one of the genera now noted would appear to be confined to the Pacific States and Territories. The genus *Annaphila*, recently founded by Mr. Grote upon a Californian species, *Ann. diva.*, is remarkable for the lightness of the color of the lower wings, the system of coloration much resembling that of the genus *Catocala*. The insects fly in the hottest sunshine, and with the greatest rapidity, alighting only occasionally, when the harmony of color existing between the upper wings and the lichen-covered rocks or trees to which they attach themselves, renders them almost invisible. They are, therefore, very difficult of capture, and can really only be taken while on the wing, the process requiring a sharp eye and a steady hand. Nothing whatever is known of their larval condition. *A. diva*, *A. depicta*, and *A. amicula* are the most common of the group, the remainder being only found in my own collection or in that of my friend Dr. Behr, who has generously placed his unique species at my disposal for description. I have in all cases adopted his MS. specific names as applied to the specimens in his cabinet. The genus *Axenus* is found on flowers in the early spring, the species *Ax. arvalis*, on which Mr. Grote has founded the genus, being common in warm pastures throughout the State, as early as the first weeks in March. It is to be expected that diligent search, particularly in the southern portion of the State, will reveal many other species of these beautiful and interesting moths, and the attention of entomologists is earnestly directed to them.

Anarta Kelloggii, n. sp. Hy. Edwards.

Head, thorax and abdomen, black, with silver gray hairs.

Primaries, black, mottled with silver gray. The basal half line and the t. a. are indistinct, the latter only very slightly dentate; orbicular and reniform, very distinct, the former brownish, the latter surrounded by a white cloud. T. p., bent anteriorly after reaching the middle, distinct near internal margin, and edged outwardly with gray. Sub-terminal line whitish, tri-dentate, edged anteriorly with black shade, most strongly marked on the costa; marginal line black, cut with white streaks. Fringes blackish, mottled with gray.

Secondaries, black, with white median fascia, not reaching to anal margin. Fringes, white.

Beneath, both wings are largely white. Primaries, with the base and a broad sub-marginal fascia, dusky black. Secondaries, with base, small discal spot, and rather wide sub-marginal band, also dusky black.

Expanse of wings, 1.35 inches.

(Coll. Hy. Edwards, No. 5534.)

Taken in Tuolumne County, California, by Dr. A. Kellogg, to whom I am indebted for much valuable material, and to whom, with sincere regard, I dedicate this species. It is allied to *A. melanopa* of Labrador, but differs considerably by the more elaborate markings of the primaries, the much wider black margins of the secondaries, and the darker and more pronounced coloring of the under side.

Anarta crocea, n. sp. Hy. Edwards.

Primaries, grayish brown, speckled with black. Basal half line much bent inwardly at its conclusion. Between it and the t. a., the space is covered by mingled brown and white scales. T. a., which is gray, edged with black, runs obliquely from costa to beyond the middle, then forms a double tooth as it reaches the internal margin; orbicular and reniform, white, well defined; median space darkest towards internal margin. T. p., white, with anterior edge blackish, rounded from costa, and almost lunate in form. Behind it are many white scales on a brownish ground, most strongly marked on the costa. Subterm. consisting of a blackish shade, approaching the t. p. by a series of black dots. Fringe, gray, mottled with black. Thorax and abdomen, light gray, sprinkled with black.

Secondaries, yellow orange at base, with rather wide black margin. Fringes white.

Beneath, the wings are yellow orange, the lower side the darkest, with rather wide black margin, the costa of each sprinkled with brownish scales.

Expanse of wings, 0.85 inch.

Dalles, Oregon. (Coll. Hy. Edwards.)

It is possible that this species may form the type of a new genus, though the similarity of its system of coloration to the European *A. myrtilli*, induces me to place it here.

Melicleptria venusta, n. sp. Hy. Edwards.

Head and thorax, rich chocolate brown; abdomen, black, with the anal hairs golden brown.

Primaries, with the base and outer margin rich chocolate brown. T. a., deeply notched anteriorly in the center. T. p., with a tooth extending outwardly, the space between these lines being cream white, except on the costa, where there is a light brown spot. Orbic., obsolete. Reniform, distinct, ovate, dusky. Fringes, brown.

Secondaries, blackish brown, with large white patch occupying the whole of the center of the wing, but not reaching to the anal margin. In this space near the base are some black scales. Fringes, white.

Beneath, primaries largely white, with costa and base broadly blackish, and a very large and distinct black discal spot. Margins, blackish, widely so at apex. Secondaries, same as the upper side.

Expanse of wings, 1.05 inch.

(Coll. Hy. Edwards.) Kalamath Lake, Oregon. Lord Walsingham.

A most exquisite and remarkable species.

Melicleptria vaccinic, n. sp. Hy. Edwards.

Anarta vaccinic. Behr. MSS.

Head and thorax, brown, with a few brown scales; abdomen, blackish brown, with the base of segments whitish.

Primaries, light brown, with a golden tinge; base of the wing darker than the other portion. T. a., only moderately curved, very slightly dentate anteriorly as it reaches the internal margin. Median shade, whitish, brown as it reaches the costa. Orbicular, almost obsolete. Reniform, large, distinct. T. p., whitish, bent considerably outwards near costa, nearly straight towards internal margin. Sub-term., sharply toothed in the middle; resting upon this line are four or five black dashes. Fringes, shining golden brown, with darker patches.

Secondaries, black, with median white fascia, broadest behind the middle, but not reaching to the anal margin. Near the outer margin is a small white streak, suggesting a sub-marginal band. Fringes, white.

Beneath, primaries black, reddish near costa, with broad median band, a kidney-shaped spot near apex, and anteriorly notched marginal band, all cream white. Secondaries, black, with a large space near the costa, reddish white, and a nearly oblong spot in center of wing, cream white. Behind this is also a small white spot. Fringes of both wings as in the upper side.

Expanse of wings, 0.75.

(Coll. Dr. H. Behr.) Sierra Nevada, Cal.

Melicleptria fasciata, n. sp. Hy. Edwards.

Primaries, fawn drab. Between t. a. and base, a slightly darker streak extends along the internal margin, and more slightly along the median nervule. T. a., almost obsolete. Median space, whitish, forming with white fascia of secondaries an almost continuous band. Orbicular and reniform, white, distinct. T. p., blackish, commencing very near the apex, then slightly bent inward, and straight as it reaches the outer margin; behind it a dark externally toothed shade. Margin, whitish, with fringe a little darker.

Secondaries, black, with rather narrow white median fascia, toothed in the center, and not reaching the anal margin. Fringe, white.

Beneath, primaries largely whitish, with a streak from base almost to center of wing, and a large irregular blotch on apical margin, black, leaving the interior margin, a large portion of costa, and the apex, white. Along costa of both wings are a few reddish scales.

Expanse of wings, 0.80.

(Coll. Hy. Edwards, No. 203.) Placer Co., Cal.

Very nearly allied to *M. vacciniæ*, of which it may possibly be the other sex; but the differences of the under side are very striking, and while the base of the primaries is almost black in *vacciniæ*, in the present species it is dark fawn drab. The t. a. and t. p. lines are also much straighter than in the preceding species, and the median shade, with white fascia of secondaries, form a much more continuous line.

Melicleptria oregonica, n. sp. Hy. Edwards.

Anthœcia oregonica. Behr. MSS.

Head, thorax, and abdomen blackish, with gray hairs.

Primaries, chestnut brown, with golden reflection. As in *M. suetus*, Grote, the traces of the ordinary lines are lost. The base is dark, almost black, with the orbicular white and well defined. Beyond the middle and inclosing the reniform is a white band, bent inwardly, indistinct on costa, and not reaching to the internal margin. Sub-term., nearly straight, whitish.

Secondaries, blackish brown, with rather broad white median fascia, which is interrupted and almost divided near anal angle. Near exterior margin is also a white oblong spot. Fringe, whitish.

Beneath, primaries, white, with two nearly square spots in center, a line resting on the anterior one directed towards the base, and an almost regular sub-marginal band, brownish black. Secondaries, also white, a large kidney-shaped discal spot, and a marginal band reaching from base beyond anal angle, blackish.

Expanse of wings, 1.00 inch.

Coll. Dr. Behr. (Hy. Edwards, No. 4405.) Oregon. Colorado.

Heliothis Crotchii, n. sp. Hy. Edwards.

Fawn drab, with blackish brown markings. T. a., much toothed exteriorly near internal margin. Median shade, pale. Orbicular and reniform, both distinct, the latter surrounded by a brownish cloud. T. p., commencing very near the apex, bending inwardly about the middle, thence almost straight to internal margin. Beyond this is a brownish, dentate fascia, the dentations formed by the sub-term. line. Marginal line composed of black dots. The whole of the nervules are pale and distinct, giving a reticulated appearance to the surface.

Secondaries, dusky, whitish towards the base, with clouded discal dusky spot.

Beneath, yellowish drab; primaries, with large discal spot, and some dashes near the base, blackish brown; margin, wide, dusky, with sub-terminal line

pale. Fringes, drab, mottled with brownish. Secondaries, yellowish drab, with oblong discal spot, marginal and sub-marginal band, dusky. Thorax and abdomen, yellowish, with darker scales, both paler beneath.

Expanse of wings, 1.00 inch.

(Coll. Hy. Edwards, No. 5533.) San Diego. G. R. Crotch.

Axenus ochraceus, n. sp. Hy. Edwards.

Very similar to *A. arvalis*, Grote, but differing by a large basal dark space, and by the t. a. being bent angularly forward on the costa, not nearly straight as in the more common species. The median shade is gray and well defined, contrasting very strongly with the rest of the wing surface, which is ochreous brown. The whole of the lines are more strongly marked than in *arvalis*. The secondaries are blackish at the base, with a decided ochreous band, enclosing a narrow black fascia. Fringes, yellowish. Beneath, ochreous, with same markings as those of the upper side, but much fainter in tone. The posterior wings have almost an orange tint. Size of *arvalis*, of which, should it prove to be a variety, it is certainly a very extreme one.

San Diego. G. R. Crotch. (1 ♀. Coll. Hy. Edwards, No. 5535.)

Axenus amplus, n. sp. Hy. Edwards.

A very distinct and peculiar species, in which the wings are much broader and more rounded than in *arvalis*, and the lines and spots, with the exception of the sub-term., utterly obliterated. The color is greenish olive, with a few white scales sparsely scattered over the whole surface of primaries. Sub-term. line, whitish, much curved inwardly as it reaches the internal margin. Secondaries, with faint discal dot, a few scales, and an imperfect sub-marginal band, whitish. Fringes of both wings, white. Beneath, greenish drab, the primaries darkest, discal spot paler, large, reaching almost to costa. The secondaries have the base dusky, with three more or less perfect dusky fascia. The margins of both wings are black, and the fringes greenish drab.

Expanse of wings, 0.80 inch.

Lake Klamath. Oregon. Lord Walsingham, by whom a ♂ and ♀ were kindly added to my collection.

Annaphila arvalis, n. sp. Hy. Edwards.

Erastria arvalis. Behr. MSS.

Primaries, dull, grayish black, with all the lines exceedingly indistinct. The t. a. black, only slightly notched exteriorly, and edged posteriorly with whitish. Median shade, blackish, with a few whitish scales beyond. Reniform, almost lost in the gray scales surrounding it. Fringes, blackish, flecked with white.

Secondaries, pale yellow, with a dull black basal triangular patch, enclosing some yellow spaces. Margin, very narrow, even narrower than in *A. depicta*, Grote, and almost regular interiorly.

Beneath, both wings are yellow. Primaries, with broad black margin, widest at apex, and a narrow black transverse fascia, slightly bent outwardly

near anterior margin. Secondaries, with narrow marginal band as in the upper side, and narrow waved median band, behind which is a black discal spot.

Expanse of wings, ♂ 0.90. ♀ 1.05.

The largest of the species of the genus known to me.

Sierra Nevada, Cal. (♂ ♀. Coll. Dr. Behr.)

This is in some respects intermediate between *A. depicta*, Grote, and *A. danistica*, Grote, but differs from the former by its pale color, and by the absence of the discal spot of secondaries above, as well as by its larger size, and from the latter by the very different ornamentation of the under side.

Annaphila lithosina, n. sp. Hy. Edwards.

Erastria lithosina. Behr. MSS.

Primaries, dark fawn-color, with the markings all rich velvety black. Basal half-line more distinct than usual in this genus, and inclosing posteriorly a few white scales. T. a., very deeply dentate outwardly in the middle. Median shade, blackish, with a few bluish scales, especially around the orbicular, which is dark fawn-color. T. p., also dentate exteriorly, becoming almost straight as it reaches the margin. Outside the t. p. is a large, ovate, pure white spot, nearly reaching the costa. Reniform, obsolete. Beyond this, there is a bright fawn-colored shade, spreading from costa to internal margin, and joining the sub-term. line, which is blackish, terminating on costa in a white dash, and surrounded at apical angle by a few bluish scales.

Secondaries, bright orange; margin rather broad, deep black, widest towards costa, and deeply toothed internally. Basal space, blackish, with imperfect orange blotches, and a small black spot near anal angle.

Beneath, primaries, bright orange; transverse fascia, broad and nearly straight, black patch at the margin inclosing some yellow spots. Secondaries, margin as in the upper side, with a waved, broken fascia near the base. There is also a minute black spot resting on the costa.

Expanse of wings, 0.90 inch.

Sierra Nevada, Cal. (Coll. Dr. H. Behr.)

Dr. Behr informs me that this exquisite species is taken on the flowers of *Sambucus*. I saw a single specimen during the past summer at the Big Trees, Calaveras Co., which was hovering about the flowers of Dogwood (*Cornus Nuttallii*).

Annaphila amicula, n. sp. Hy. Edwards.

Primaries, blackish, with gray lustre. T. a., bi-dentate near the interior margin. Orbic., small, round, grayish. T. p., nearly straight, with only one tooth near the middle. Reniform, large, almost lost in the gray color which clothes the outer portion of the wing. Sub-term., velvety black, not reaching more than half way across the wing, divided on costa, and then inclosing some white scales. Marginal line, divided into a series of dots. Fringes, grayish.

Secondaries, bright orange, base black, extending along the anal margin, where the black line is slightly cut by an orange streak. Marginal band, rather narrow, but wider than in *A. depicta*, and only slightly notched interiorly. The discal spot is large, and a narrow black fascia, bent outwardly near the middle, extending across the wing.

Beneath, primaries, bright orange, shading into yellow on internal margin, a narrow transverse fascia, perfectly straight, and a large oblong discal spot, black. The margin broadly blackish, with yellow scales, widest at apex, and extending along costa, almost to the extremity of the transverse line. Secondaries, orange, with median transverse fascia, toothed near anal angle, and an oblong discal spot behind it, black. Between this and the marginal band are a few spots, suggesting the idea of a submarginal fascia. Margin, blackish, flecked with orange scales.

Expanse of wings, ♂ 0.60. ♀ 0.75.

San Mateo Co., Cal. (Coll. Hy. Edwards, No. 2587.)

Annaphila germana, n. sp. (?) Hy. Edwards.

Probably only a variety of the preceding. The primaries are exactly like those of *amicula*, except that all the lines and marks are more distinct, and the gray shade beyond the t. p. lighter in color and more strongly marked. The secondaries are bright orange, but have no median fascia, and the base is wholly black, while the marginal band is much wider than in the last species, and less deeply toothed interiorly. Beneath, there is little difference, except that the spots and lines are rather less strongly marked.

Expanse of wings, 0.75 inch.

Napa Co., Cal. (1 ♀. Coll. Hy. Edwards, No. 4379.)

Annaphila domina, n. sp. Hy. Edwards.

Primaries, darker than in any other known species, being deep black, with shadings of gray. All the lines, except the basal half, distinctly marked. T. a. almost straight, or with only a very small dentation in the middle. Orbic. and reniform, distinct, velvety black, the latter almost oblong. Across the median shade is a small patch of white scales, and a larger one outward of the t. p., which is arched on costa, dentate inwardly near the middle, and then continued straight to internal margin. Sub-term. almost wanting, the posterior margin of wings being dull slate-black, with no distinct markings. Fringes, also slate-black.

Secondaries, rich dark orange, with moderately wide border, only slightly notched internally, and extending all round the wing to the base, with an oblong discal spot, black. Fringe, black.

Beneath, the primaries are marked with the same system of coloration as those of *A. danistica*, but the orange is very much darker and richer in shade. The discal spots are three in number, each circled with orange. Beyond them is a transverse arcuate line joining another, extending along internal margin to base of wing. Margin, dusky black, apices broadly so. Secondaries, orange, with some scattered black scales along costa, and a black marginal band of moderate width extending to the base, speckled with white scales.

Discal spots small, almost linear. Tarsi and under side of abdomen with greenish and golden scales.

Expanse of wings, 0.75 inch.

San Mateo Co., Cal. (♀. Coll. Hy. Edwards, No. 5720.)

Annaphila superba, n. sp. Hy. Edwards.

Head, thorax, and abdomen, brownish black, sprinkled with gray scales.

Primaries, also blackish, with gray scales. The whole of the lines rather indistinct. Median shade, dark, with whitish scales. Orbic., obsolete. Reniform, blackish, surrounded by white ring. T. p., whitish, bent outwardly near the middle. Beyond this are some white scales, forming an imperfect fascia. Sub-term., black, not reaching internal angle, and between it and the margin are a few more white scales.

Secondaries, bright crimson red, margin of medium width, black, quite regular, and not toothed in any portion.

Beneath, both wings orange-red, shading into yellow, and surrounded by rather broad black margin. Primaries, with discal spot, and faint submedian fascia, black. Secondaries, with discal spot, and faint transverse line near the base, also black. Fringes, above and below, grayish.

Expanse of wings, ♂ 0.55. ♀ 0.70 inch.

Marin and Napa Counties, Cal. (Coll. Hy. Edwards, No. 4381.)

A very beautiful species, not to be confounded with any other, the bright crimson of the lower wings (as rich as in those of *Catocala cara*) and the regular black margin serving to distinguish it.

LIST OF SPECIES DESCRIBED IN THIS PAPER.

Anarta Kelloggii, n. sp. .... Sierra Nevada, Cal.
" *crocea*, n. sp .... Dalles, Oregon.
Melicleptria venusta, n. sp .... Klamath Lake, Oregon.
" *vacciniæ*, n. sp .... Sierra Nevada, Cal.
" *fasciata*, n. sp .... Placer County, Cal.
" *oregonica*, n. sp .... Oregon—Colorado.
Heliothis Crotchii, n. sp .... San Diego.
Axenus ochraceus, n. sp .... San Diego.
" *amplus*, n. sp .... Dalles, Oregon.
Annaphila nivalis, n. sp .... Sierra Nevada, Cal.
" *lithosina*, n. sp .... Sierra Nevada, Cal.
" *amicula*, n. sp .... San Mateo County, Cal.
" *germana*, n. sp. (?) .... Napa County, Cal.
" *domina*, n. sp .... San Mateo County, Cal.
" *superba*, n. sp .... Napa and Marin Counties, Cal.

Dr. Kellogg described a new plant, as follows:

Lilium Maritimum.

BY DR. A. KELLOGG.

Lilium maritimum. Kellogg.

Leaves alternate or rarely verticillate, chiefly clustered near the base, narrowly oblong-oblanceolate, subobtuse, narrowing into a short petiole, 3-nerved (intermediate or secondary nerves obscure), margins scarcely a little scabrulose, quite glabrous throughout, upper cauline successively diminishing to minute linear-lanceolate sessile leaves, barely ¼ of an inch. Peduncles elongated, terminal. Flowers few (1–3), somewhat nodding, short, or equilaterally obconic-campanulate; segments lanceolate, slightly revolute above the middle; genitals included, about equal; style short, straight.

Deep reddish orange-brown, inside dark purple spotted.

A small maritime lily found in the black, peaty, low meadows exposed to the bleak, foggy climate of the coast of California, in the vicinity of San Francisco. A lily not liable to be mistaken for *L. parvum*, K., or any depauperate form of *L. pardalinum*, K., as both of these have rhizomatic scaly bulbs, creeping, as it were, or spreading laterally into zigzag mats or masses, if the soil be rich or moisture favorable. Like the Oregon lily, this has isolated bulbs—both too hastily considered as varieties of *L. canadense*, like many others. This elastic species, for a lily hobby, is almost equal to any emergency; in the realm of speculative philosophy, this may have been truly the progenitor. From *L. canadense*, its nearest kin, it differs essentially in the genitals being included; a point not only of specific but generic importance. Flowers small, scarcely more than an inch in expansion, and of similar depth—giving it a truly equilateral obconic cavity, much more shortened and shallow-shaped. Style even shorter than the stamens. The perianth never pendent when in flower, but half erect, and looking outwards. Stem in general the smallest known—12 to 18 inches high, etc. I do not insist upon the absolute or relative form of the leaf being always narrower, although for the most part this is so; and very seldom do we see more than a single whorl, although cultivated remote from the coast, in light sandy soils; the leaves then may become broader, somewhat oblanceolate, acute, and sessile, but never pubescent along the veins. Salt margins of our sea-coast do certainly modify the forms of plants; yet, with all due allowance, the entire physiognomy is not so changed as we witness here.

In general, the bulb is pure white, strictly conic, scales closely pressed, 1 to 1½ inches in diameter; leaves 1 to 5 inches long, ¼ to ½ inch wide, rarely verticillate. Flowers May to August. Capsules long, narrow, not winged. The late lamented H. G. Bloomer, Botanical Curator, has long ago recorded his protest against this being considered a variety of *L. canadense*.

Dr. Gibbons made some verbal remarks on clouds.

Dr. C. F. Winslow, a former member of the Academy, being present communicated for record the following statement in order that investigations might be made upon the subject when opportunity might occur hereafter.

In 1853, in passing a barber's shop on Kearny Street, he saw a fragment of a large bone, appearing to be a portion of a tibia of some gigantic quadruped or reptile. He purchased it and still has it in possession, stored at Boston with his collections. He sent it to Professor Leidy several years after obtaining it, and the Professor pronounced it to belong to a gigantic sloth of an extinct and undetermined form. He sent it also to Professor Baird of the Smithsonian Institute, that a cast of it in plaster might be taken for preservation in case of loss of the original. This fragment was in an excellent state of preservation. The history of its discovery and location is this:

When workmen were engaged in digging a well, about the year 1852, where Dr. Frederick Zeile's Baths are now located, (that is, in the rear of 524–528 Pacific Street, San Francisco,) at the depth of about 23 feet they struck a hard whitish object, which on being thrown out was discovered to be the leg bone of some large animal. It was broken into several pieces, and the barber secured this fragment which he preserved, and for which he wanted a big price. The Doctor succeeded in getting it for three dollars. He then found one of the men who had been employed to dig the well, and was informed by him that the excavation went through one of the limbs of the skeleton, and that the whole of the rest of it was still embedded in the yellow silt through which they dug till they came to water. The workman judged the depth at which the skeleton laid to be about 23 feet below the surface.

When Dr. Zeile's brick building was put up, Doctor Winslow observed that the rear wall just embraced the well within its area; and he has always considered it possible to reach the skeleton without injury to the edifice, by careful excavation.

This gigantic fossil is probably entirely new to Science, and would be of great value to the collections of the Academy.

The Doctor hoped efforts might be made to explore this spot and obtain the bones. If the rest of the skeleton was as well preserved as the fragment he has, it could be easily and safely put together, and would be a priceless acquisition to the museum.

REGULAR MEETING, JUNE 22, 1875.

Vice-President Gibbons in the Chair.

Twenty-four members present.

Donations to the Museum: Hon. F. Berton, Swiss Consul, presented a bronze medal cast in honor of Agassiz.

Dr. Wm. Gibbons, of Alameda, read a description of a new species of trout from Mendocino County, as follows:

Description of a New Species of Trout from Mendocino County.

[Typical specimen in the Collection of California Academy of Natural Sciences.]

BY W. P. GIBBONS, ALAMEDA.

Salmo mendocinensis. Gibbons.

Body stout; outline from the nape of the neck to the snout, somewhat incurved; dorsal outline, but slightly arched; tail, truncated; head, medium size; from the anterior margin of the dorsal to the snout, nine-tenths of an inch less than from the same point to the insertion of the tail. Teeth numerous, moderately stout, incurved, fifteen to twenty on each maxillary; nine stout incurved teeth on each pre-maxillary; two double teeth on the knob of the vomer, four on the shaft; palatal teeth recurved, thirteen on each side; five teeth on each edge of the tongue; about thirteen on each side of the lower maxillary. The end of the lower jaw projecting about half an inch beyond the obtusely rounded snout, which receives in a notch its knobbed extremity. Center of the eye on a line drawn from the extremity of the snout to the end of the lateral line.

Br. 12–13, D. 12, P. 13, V. 10, A. 13, C. $\frac{14}{8}$.

Vertical line from the posterior extremity of the upper maxillary, four-tenths of an inch behind the posterior edge of the iris.

Adipose and anal opposite; ventral terminates under the middle of the dorsal. No spots on A., V., or P. Dorsal and adipose with oval dark spots.

From tip of snout to nape of neck, 4 inches.

Number of times contained in total length, 6.75.

From tip of snout to farthest point on free margin of operculum, 6 inches.

Number of times contained in total length, 4.5.

Total length, 27 inches.

From tip of snout—To anterior edge of iris, 2 inches.
" " To posterior edge of iris, 2.75 inches.
" " To extremity of superior maxillary, 2.63 inches.
" " To anterior base of dorsal, 10.75 inches.
" " To posterior base of dorsal, 14 inches.
" " To anterior base of adipose, 19.75 inches.
" " To base of tail along lateral line, 24.50 inches.
" " To base of tail, superior, 22.25 inches.
" " To base of tail, inferior, 22.75 inches.
" " To anterior base of anal, 17.50 inches.
" " To anterior base of ventral, 12.50 inches.

Greatest depth of body, 6.5 inches.

Color above lateral line when first taken from the water, cupreous iridescent, gradually blending to silver-white along the belly; the colors soon fade to gray.

The typical specimen from which this description is taken is a male of 7.5 lbs. weight. The average weight of the fish is about 12 lbs. The largest that has ever been caught weighed 28.5 lbs.; the smallest that come to spawn, 4 lbs. The color of the male is darker than that of the female. The male has very few spots, while the female is covered with them, except the belly: the spots along the sides are larger than the others. When first caught, the females are of a bright silver color; hence, some call them "silver salmon." The flesh of some is nearly white; of others, yellow or salmon-color. The males are deeper from back to belly, and thinner, than the females.

The spawning season commences usually the latter part of March, and lasts about a month. The hookbill goes from the first to the last of January; the Sacramento salmon, from the middle of January to the middle of February. Both invariably depart before this fish commences to spawn. They come up in pairs, and select different kinds of locations from the hookbill and the Sacramento salmon. They will take a fine ripple caused by a large rock or by tightly packed gravel, about which there is always some dead water. After brushing away the sediment, if any has accumulated, they lay their eggs, well distributed, seldom more than two or three clusters touching. They never cover their eggs with sand, as some fish do; nor do they dig holes, as the hookbill; nor select holes among large rocks, as the large salmon occasionally does. The period of incubation is not known. When hatched, the little fish must work down stream, as none are found in the rivers save those which are between half a pound and three pounds in weight. Like salmon, they must go to the sea and mature; though this voyage is not absolutely necessary, as some remain during the entire year, when the streams, drying up, prevent them from passing down; but, generally, they seem to depart before the water falls so low. Those caught in the fall, which have remained during the summer, are generally in as good condition as those which appear in the spring. They eat small fish and frogs, when in the spawning-beds. It seems to make no difference how large the fish may be, as to their stopping in fresh water. They are very sagacious about the time and place of depositing their spawn, when there are no large fish to prey upon them; nor do they lay them in such localities as the water may subside and leave them exposed.

Still they have numerous enemies, among which is a small trout which returns to the main streams in April, having either gone to smaller and clearer streams in winter, or hidden themselves; for I have never been able to find them in the main creeks during the winter. There is also a species of diver, mostly white, and larger than a wood-duck, which lives almost exclusively on the eggs during the season. This fish comes up all the streams that empty into the coast near this place.

I am indebted to Mr. Joseph H. Clarke, a corresponding member of the Academy, for the foregoing intelligent description of the character and habits of this trout. It has been a subject of careful observation with him for the past two or three years. The Academy is under furthur obligations to him for sending several specimens, which have formed the basis of the *description* of this species. It would afford me pleasure to recognize Mr. Clarke's contribution to science by giving his name to this fish; but there is already a *S. Clarkii*, described by Richardson.

Dr. Kellogg described a new species of Lily, as follows:

Lilium Lucidum.

BY DR. A. KELLOGG.

Lilium lucidum—Kellogg.—Leaves whorled, scattered below and above, lanceolate, or ovate lanceolate, very short petioled, or subsessile, pseudo-triplinerved or somewhat 3-nerved, smooth throughout, short peduncled. Flowers few (or 1—6), nodding, sepals sessile, lance-acute, strongly turbinate-revolute, thickened at the base, genitals exserted, about equal; style straight, thick, light translucent yellow-orange, the dark purple spots on the inside visible from without. June to August.

Bulb spheriod, or slightly depressed oblate-spheroid; scales thickened lanceolate, acute, strongly incurved and very closely appressed; whitish, with yellowish-greenish tinge, 1½—2 inches in diameter; isolated; perennial; stem more central, 2 to 3 feet high, quite glabrous throughout; shortish thick peduncles from axils of bractoid leaves; lower and larger leaves 1—1¼ inches wide, about 3—4 inches long, diminishing above; flowers 1½ inches expansion, 1 inch deep; style, ½—¾ inch long.

A lily from Oregon and Washington Territory, long known, but also considered by authorities as another variety of *L. Canadense*. Without recapitulating the isolated and peculiar perennial bulb, position of stem, form and color of flower, surface, equal genitals, etc., we take these to be constant characters. Indeed, the very revolute sessile sepals remind us more of *L. Superbum* than *Canadense*, while the smaller, closer flowers and thickened base are peculiar. These points were distinctly discussed and shown to the Academy about fifteen years ago, when this same painting, accompanied by specimens, was on exhibition; and our opinion then given as to its being a distinct species. Having no bulb in hand at the time to verify statements or complete the manuscript, it was held in abeyance, we believe, although the description was then written.

Judge Hastings read three papers on the following subjects: "On the Genuineness of Archæological specimens, including Ancient Coins;" "A Plan for the Construction of Levees for reclaiming land;" "San Francisco as a point for an Astronomical Observatory."

Amos Bowman read a paper on "The Geological Formation of California."

REGULAR MEETING, JULY 6TH, 1875.

President and Vice-Presidents being absent, R. E. C. Stearns was called to the Chair.

Owing to a misapprehension on account of the night of meeting, only six members were present, and the meeting adjourned without transacting any business.

REGULAR MEETING, JULY 19TH, 1875.

Vice-President Gibbons in the Chair.

Twenty-three members present.

Donations to the Museum: Duplicate fossils, "Types of Dana's exploring expedition to Australia and Japan." From Henry Edwards, specimens of *chætiles crenita*, *spirifer glaber* and *Platychisma occulis* from Australia; also specimens from the miocene, Oregon, *cleobis grandis*, (N. S. Wales,) *Pleurotomaria Morrisiana*, (N. Z.), lignite from Astoria, Oregon; Crustacean from the Bay of San Francisco. From W. Sublette, *Chimœra Calliniensis*. From W. A. Woodward, galena ore from Searsville, San Mateo County. Quicksilver ore with garnets, Sonoma County, from

R. R. Craig. Samples of *Annatidæ* found floating in the Pacific by the donor, Dr. O. M. Wozencraft. Five birds from F. Gruber. *Fontinalis antipyritica* from Ireland, from Dr. R. K. Nuttall. Specimens of ore from R. R. Craig; also ores from O. P. Callaway.

The following paper by Henry Edwards was read by the Secretary:

Pacific Coast Lepidoptera.—No. 13. On the Earlier Stages of Vanessa Californica.

BY HENRY EDWARDS.

In a very interesting and valuable article by Dr. H. Behr, on the "Vanessidæ of California," published in the third volume of this Society's Proceedings, reference is made to the large swarms of *Vanessa Californica* observed some years ago in the neighborhood of San Francisco, and the simultaneous occurrence in various parts of the State of this insect, which, in ordinary years, cannot be otherwise regarded than as one of our rarer species. By a fortunate circumstance, I am enabled to add a few facts to the natural history of this butterfly, and at the same time to present a description of its earlier stages, which have been hitherto unrecorded. In an excursion up the cañon at the head of Richardson's Bay, at the base of Mount Tamalpais, on the 9th of May last, I observed, soon after leaving the open fields and passing into the more secluded portion of the gulch, myriads of caterpillars on every side, swarming on the ground and on every blade of grass. A further and closer search disclosed the fact that the bushes of *Ceanothus thyrsiflorus*, which here attain a large size, sometimes reaching as great a height as twelve or fifteen feet, were utterly stripped of their leaves, looking as if some pestilence had passed over them, and destroyed every vestige of their flowers and foliage. It was not difficult to divine that this denudation was owing to the multitudes of caterpillars which had made their home upon the plants, on which they were to be found in nearly all the stages from about the third moult to full grown larvæ. It is not too much to say that they could be counted in millions, for, in following the creek, which runs through the cañon, for upwards of a mile, I found the *ceanothus* growing abundantly, and the same circumstance of the immense numbers of the insect, and consequent destruction of the foliage of the plant, everywhere displayed themselves. The eggs of the parent insect appear to have been deposited in clusters, as I noticed upon the extremities of many of the branches small webs in which the cast skins of the young larvæ were very abundant, thus suggesting the idea that in their earlier stages the caterpillars are gregarious, not separating from their common home until about the period of the third moult. I found several of these skins sufficiently perfect to enable me to offer a fair comparison of the young larvæ with their appearance in the more advanced stage in which they came immediately under my observation. I sought carefully for any *Ichneumonidæ*

or other parasitic insects which might be present, imagining that so large an assemblage of larvæ would prove for them a certain attraction, but I did not succeed in taking a single specimen, nor as yet have any appeared among the caterpillars which I brought home with me. I have, however, observed in my breeding boxes four examples of a rather large dipterous parasite, probably of the genus *Tachina*. As, however, I carried away with me nearly ninety caterpillars, all of which passed successfully into the chrysalis state, this is but a very small proportion to be affected with parasitic enemies. Is it possible that this comparative immunity is owing to the sharp and formidable looking spines with which the caterpillars are furnished? Certain it is that the *Vanessæ* generally are more exempt from the attacks of Ichneumons than most other butterflies.

During the last summer, the young lupines in the Golden Gate Park were attacked by myriads of caterpillars, which at one time threatened their destruction, but the preservation of the small birds in and about the park kept down the swarm, and a succession of very cold winds, during the middle period of their growth, killed them off in thousands. I raised from the caterpillars, of which I took away with me upwards of a hundred, no less than eighty-five specimens of *Pyrameis Cardui* and *Pyrameis Huntera*, and not a single one among them was observed by me to be attacked by parasites. This, in conjunction with the facts noted above, with reference to *Vanessa Californica*, would seem to indicate that these insects enjoy a freedom from the assaults of their tiny foes, which is not granted to other members of their tribe. It may partially account for the vast swarms of the various species which periodically make their appearance in different parts of the world. But this is one of those singular occurrences connected with insect life, which are so difficult to explain satisfactorily. The cañon in which *Vanessa Californica* was found has been visited by J. Behrens and myself at least twice every season for the last six years, and though I have invariably sought most diligently for caterpillars, until now that of the present species has been utterly unknown to me.

It may with almost certainty be predicted that the coming fall will witness the same large swarms of this butterfly as those observed by Dr. Behr in 1856 and 1866, which dates will serve to indicate that the insect appears in such numbers about once in nine or ten years. The caterpillars collected by me fed voraciously, and changed into the chrysalis state from the eleventh to the twenty-fourth of the month, the transformation of all I had secured being complete by the latter date. In this condition, they were extremely restless, constantly keeping up a jerking motion, and knocking themselves against the lid and sides of the boxes in which they were placed, with such force as to be heard all over the house. On the 23d of May, my friend Samuel Williams, of the *Evening Bulletin*, was enjoying a picnic in the cañon mentioned above, when the attention of his party was drawn to a very singular noise in the bushes over their heads, the cause of which it was for a time difficult to discover. At last it was found to proceed from myriads of chrysalides, attached to the leafless stems of the *ceanothus*, which, by a constant motion of their bodies, gave a trembling to the branches of the shrub, and produced the singular and half weird noise referred to. The perfect insects began to appear on the 25th of May, and did not all emerge until the 6th of June, the average

time in the chrysalis state being about fourteen days. The young caterpillars are wholly jet black, with the spines shorter than they are towards maturity, and without any trace of the steel-blue, shining tubercles, which are so strong a characteristic of their more advanced stages.

After the third moult the following is the appearance of the caterpillar: Head, moderate, jet black, shiny, with two short branched spines on the crown, and a series of smaller ones on the sides in front. In the center of the head is a groove. Body, deep velvety black, each segment behind the head with five branched spines, at the base of which are bright, steel-blue tubercles. In the sunlight, these tubercles, from their highly polished surface, glisten almost like jewels. Between the spines, and particularly about the dorsal region, are a number of small white circular dots, from each of which springs a short whitish hair; and a rich black velvety line, sharply defined, extends from the base of the head to the anal segment. The latter is furnished with only two branched spines. Prolegs, black; abdominal legs, dirty yellow. Length, 1.00 inch.

Mature larva. There is no change except in size until the final moult, when the middle spine of each segment becomes bright yellow at the base, and the white spots at the base of the hairs larger and more numerous, giving the appearance of a yellow dorsal line. Length, 1.65 inch.

Chrysalis. General color, ashy gray, with bluish efflorescence; abdomen, fawn-color; head, with two rather sharp, well developed, blackish processes; thorax, mottled with brownish, with two angular spines near the junction of the wings; mesonotal process, rather large, brown, with sharply hooked spine directed backwards. On the sides of the thorax are four black points, the basal ones surrounded by a cream-white patch, which extends to the first abdominal segment. Wing covers, ashy, brown along the margins; basal abdominal segment, with two small, black spines, behind which are large cream-white patches. The remaining abdominal segments have each two black points surrounded with black patches, growing smaller and fainter towards the anal extremity. Spiracles, black, almost linear, with a series of black dots above and below. The anal segments are much arched, directed inwardly toward the exterior of the wings. Length, 0.65 inch. There is no trace of silver upon any part of the surface of the chrysalis.

As *Vanessa Californica* has been said by some authors to be identical with the European *polychloros*, I subjoin, for comparison, a brief description of the caterpillar and chrysalis of the latter species. It will at once be seen how widely separate the two are, in their earlier stages. *Vanessa polychloros, L.*; Caterpillar, bluish or brownish, with a lateral stripe of orange. The spines are slightly banded and yellowish. The larvæ feed on the willow and elm, and on some kinds of fruit trees, especially the cherry. *Encyclop. Method. Papillon.* 305. *Chrysalis*, flesh-colored, with golden spots near the neck.—*Ib.*

Since writing the above, yesterday (June 6th), in company with Mr. Behrens, I paid another visit to the cañon in which we had previously found the *Vanessa*. Contrary to my expectations, the insect was far from abundant, and at least 75 per cent. of those we found were crippled in the anterior wings, while dead specimens, which had never been able to take an extended flight, were scattered everywhere about our path. The females also seemed

to take refuge at the roots of the dried-up grass, abandoning themselves to death. Well developed specimens of both sexes flew rather rapidly, alighting very frequently, and settling on stems of trees and among decayed leaves closely resembling them in the color of the under side. They also invariably placed themselves upon the branches with the head downwards. The insects appeared to be confined to a very small area, as we did not meet with any specimens except in the immediate neighborhood of the spot in which the caterpillars were taken. The crippled state of most of the imagos may be owing to the extremely dry state of the weather during the past month, the want of moisture acting upon the wings of the insect during their last stage, and preventing their proper development.

S. C. Hastings read a paper on "Phenomenal Changes of Climate in Past Epochs."

Dr. Gibbons read an obituary notice of Marshall C. Hastings.

REGULAR MEETING, AUGUST 2, 1875.

Vice-President Edwards in the chair.

Thirty-five members present.

The following new members were elected: Dr. G. King, Dr. F. W. Godon, A. W. Crawford, Pembroke Murray, Wm. Eimbeck, Jas. L. King.

Donations to Museum: Fossil bone from Tanitos Creek, San Mateo County, California, W. S. Downing. Fossil shells from Pescadero, from Milo Hoadley. Fifteen species of *Unionidæ* from W. G. W. Harford. Textile plants from various localities, from Geo. W. Dent. Specimens of ores, from Joseph Potts, Coll Dean, R. H. Rogers, A. W. Von Schmidt and Geo. W. Dent. Woods, from A. W. Crawford.

Dr. Blake read the following paper:

On Roscoelite, or Vanadium Mica.

BY JAMES BLAKE, M. D.

At a meeting of the Academy in September of last year, I presented a specimen of a new mineral, under the name of Colomite, which I then considered to be a mica, containing a large percentage of chromium. I had, at that time, made no detailed analysis of the substance, and had merely arrived at the conclusion that it was a chrome mica, from some superficial blow-pipe tests, and from its reaction with acids; knowing, also, that chromium is not an uncommon ingredient in micas. Subsequent to my last communication on the subject, Dr. Ghent, of Philadelphia, to whom a specimen of the mineral had been sent, discovered that it contained vanadium, and on his informing me that such was the case, I sent him all the specimens of the mineral I possessed, so as to enable him to make a complete analysis of it.

I shall not now enter into its chemical composition, merely remarking that, as I before observed, it is evidently a potash mica, containing about twenty per cent. of vanadium, instead of chromium, as I had before stated. I expect Dr. Ghent will shortly publish his analysis of the mineral in the *American Journal of Sciences*.

The occurrence of a mineral containing so large a percentage of vanadium is interesting, as, up to the present time, vanadium has been found in but very few substances; it is, in fact, one of the rarest of the elements, and although it has lately been discovered in some volcanic rocks, yet it is present in such small quantities—not more than one part in ten thousand—that even its detection is difficult.*

The only chemist who has successfully investigated the properties of vanadium, is Professor Roscoe, of Manchester, and I propose to name the mineral, Roscoelite, as the most appropriate name I can give it.

As I stated on a former occasion, the mineral occurs, associated with quartz, in a vein in porphyritic rock, at Granite Creek, in Eldorado Co., in the lower hills of the Sierra. It has been extremely rich in gold, the mica carrying most of the gold. The substance is interesting. under a mineralogical point of view, as affording a unique instance of so large a proportion of a pentavalent element entering into the composition of a mica, and offers, perhaps, the most curious instance of the anomalies that present themselves in the chemical composition of this class of minerals.

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*I think it probable that vanadium may occur in larger quantities in these rocks than is supposed, as I believe the methods employed for separating it are imperfect. I have mixed vanadium with basalt, and after treating it in the manner indicated for separating the substance, I obtained but about 65 per cent. of the quantity added. I have reason to believe that it forms compounds with the alumina, iron, and silica of the rocks which have not been at all investigated. Since the above was written, I find that Dr. Hall has found vanadium widely diffused in many rocks, generally associated with phosphorous, although I have been unable to detect the presence of phosphorous in the mica.

Dr. Blake related the results of some physiological experiments he had performed, to determine the molecular relations of Beryllium. Neither the specific heat of the metal, or the vapor density of its chloride, had been ascertained, and chemists were undecided as to whether it was a trivalent or quadrivalent element. Its physiological reactions, when introduced directly into the blood, so closely resemble those of alumina, that there can be no doubt but that it belongs to the same isomorphous group, and that it is therefore quadrivalent. There is also a close relation between the intensity of the physiological action of the compounds of these two metals and their atomic weights. In a series of experiments, conducted expressly to determine this point, the quantities of Be_2O_3, under the form of sulphate, required to kill 2,270 grammes of rabbit, when injected into the veins in divided doses, were .059, .061, .050 grm; and of Al_2O_3, injected under the same conditions, were .021, .023, .022 grm. The smallest quantity required to arrest the vital reactions, when introduced in one dose, was of Be_2O_3, .038 grm; of Al_2O_3, .016 grm; showing a marked increase in the physiological action of these substances with the increase of their atomic weights. This, I believe, is the first time that physiological reactions have been used to throw light on the chemical properties of a substance. Should, however, the carbon compounds follow the same laws in their physiological reactions as the inorganic elements, living matter must offer a valuable reagent in their investigation. The recent experiments of Messrs. McKendrie and Dewar, published in the twenty-third volume of the Proceedings of the Royal Society, certainly indicate that such may be the case, as in experimenting with the compounds of the Chinaline and Pyridine groups, it was found that the physiological action became stronger in going from the lower to the higher members of the series. They also observed that, in the Pyridine group, where the base became doubled by condensation, not only was the physiological action more intense, but its character was completely altered, agreeing with the salts of iron, with which analogous changes take place, both in the character and intensity of their physiological action, when the molecule is doubled in the change from the ferrous to the ferric salts. [See "Journal of Anatomy and Physiology,' vol. 3, p. 24.]

Dr. Behr described a new weed from Lower California.

A paper by W. N. Lockington was read as follows:

List of Echinidæ now in the Collection of the California Academy of Natural Sciences, May, 1875.

BY W. N. LOCKINGTON.

Suborder DESMOSTICHA.

This suborder includes the regular sea-urchins, that is, those in which the poriferous zones are continuous from mouth to apex, both of which are central, the apex with ocular, genital, and anal plates.

Family CIDARIDÆ.

Interambulacral areas very wide, with few coronal plates, each bearing a single primary perforate tubercle, surrounded by a large scrobicular circle. Actinal and abactinal systems large. Ambulacral areas very narrow, composed of numerous small plates, the pores in single pairs, and the median ambulacral spaces set with small flattened papillæ. Jaws not so complicated as in the *Echinidæ* and *Diadematidæ*. Teeth in shape of a gauge. Auricles made up of independent arches, and taking their origin from the interambulacral spaces. The spines are large and solid.

CIDARIS.

1. *C. Thouarsii*. Valenciennes. Panama. Gulf of California.

Two large specimens from the latter locality, presented by D. E. Hungerford. This species attains a diameter of about two inches.

2. *C. metularia*, Blainville. Red Sea. Mauritius. East Indies. Sandwich Islands. Feejee Islands.

The specimens in the museum are from A. Garrett, and were collected in the Sandwich Islands. This is a very small species, the largest specimen not exceeding three-quarters of an inch in diameter.

Family ARBACIADÆ.

This small family contains *Echini* without secondary and miliary tubercles; with the pores in single pairs; jaws somewhat resembling those of the *Cidaridæ*, and the auricles disconnected. The spines are solid, but thinner than those of the *Cidaridæ*, and the anal system consists only of four large plates.

ARBACIA.

3. *A. stellata*, Gray. Gulf of California. Panama.

Family DIADEMATIDÆ.

Test thin, ambulacra narrow. Spines long, hollow, verticillate or transversely striated; tubercles of ambulacral and interambulacral areas similar. Auricles not forming connected arcs. Pores in arcs composed of three pairs.

DIADEMA.

4. *D. Mexicanum*. Acapulco. Cape St. Lucas.

5. *D. setosum*, Gray. Cape Verde Islands. Japan. Sandwich Islands. Feejee Islands.

A single specimen from the Bonin Islands, presented by W. J. Fisher.

ECHINOTHRIX.

6. *E. calamaris*, A. Agassiz. East India Islands. Society Islands. Philippines.

A single fine specimen, presented by W. J. Fisher, naturalist of the "Tuscarora," and dredged from a depth of ten fathoms, off the Bonin Islands. When first brought in, there was observable a singular swelling at the apex, which led me to suspect there might be a parasitic crustacean within; a supposition which was afterwards verified by the extraction of a fine specimen of a new species of the family *Pinnotheridæ*, measuring fully 1⅙ in. across the legs. The family *Pinnotheridæ* are all parasitic, inhabiting the mantle of oysters, mussels, *Haliotis*, and other mollusks, and also, as in this instance, the extremity of the digestive canal of certain *Echini*.

Family ECHINOMETRADÆ.

This family contains many genera and species, all of them distinguished from the *Echinidæ* proper by having the pores arranged in arcs of more than three pairs. In many cases, the outline is a long oval, and the axis is oblique, that is, it does not coincide with the center of either ambulacral or interambulacral areas.

HETEROCENTROTAS.

7. *H. mammillatus*, Brandt. Zanzibar. Red Sea. East India Islands. Sandwich Islands. Feejee Islands. Gulf of California.

Alexander Agassiz, in his "Revision of the Echini," gives all these localities except the last; but we have in our collection unmistakable specimens of this fine species, brought to Prof. George Davidson from Cape St. Lucas.

The spines of *H. mammillatus* are very large, and vary in shape from that of a cricket-bat to that of a bayonet; and the test is very strong and thick.

8. *H. trigonarius*, Brandt. Mauritius. Java. Sandwich Islands. Feejee Islands.

Unfortunately, our only example of this species is a single denuded test, whereas of the foregoing we have three fine specimens; the arrangement of the tubercles in the abactinal part of the ambulacral region is, however, sufficient to establish its specific identity. The spines are usually triangular in section.

ECHINOMETRA.

9. *E. Van Brunti*, A. Ag. Peru. Panama. Gulf of California.

10. *E. lucunter*, Blainville. Zanzibar. Red Sea. East Indies. Japan. Sandwich and Feejee Islands.

Of this species we have three specimens, two of them from Japan, presented by W. J. Fisher.

11. *E. oblonga*, Blainville. Philippines. Seychelle Islands. Sandwich Islands.

STRONGYLOCENTROTUS.

12. *S. purpuratus*, A. Ag.

This species is abundant on this Coast between Puget Sound and San Francisco, but data are wanting to determine its range north and south of those points. It is eaten by the Italians. In color it is dark violet when alive, but the dried tests have a greenish tint.

13. *S. Franciscanus*, A. Ag.

This species is one of the largest of the Echinidæ, attaining a diameter of six inches across the test. It is found at various points upon the Pacific Coast, from Queen Charlotte's Island to San Diego, and A. Agassiz gives Formosa also as one of its localities.

14. *S. Mexicanus*, A. Ag.

Several specimens from the Gulf of California. The spines in this species are nearly as long as the diameter of the test; a peculiarity by which it may easily be distinguished from *S. purpuratus*.

15. *S. Drobachiensis*, A. Ag. North European Seas. North Pacific. N. E. Coast of North America.

This species is common to the more northern parts of both continents, and is found on both shores of this continent. It is, in fact, one of those animals which appear to have been driven in all directions from the pole, by the influence of increasing cold.

Our specimens, which are very fine and perfect, were presented by W. Jones, Esq., Surgeon U. S. N., and were dredged in 45 fathoms, about 6 miles off the shore of Marmot Island, Alaska, from a bottom of rock and sand.

16. *S. Intermedius*, A. Ag.

Two specimens in this collection appear to belong to this species, as they have the greenish spines and the small tubercles upon the anal system mentioned in the description by A. Agassiz; the locality, however, is different, as that author gives Japan, while these are from the Sandwich Islands.

Family ECHINIDÆ.

In this family the arcs of pores in the poriferous zone are never composed of more than three pairs. It is divided into two sub-families, the *Temnopleuridæ*, characterized by peculiar pits at the angles of the coronal plates, and the *Triplechinidæ*, which have short, straight arcs of three pairs of pores.

Sub-family TRIPLECHINIDÆ.

ECHINUS.

17. *E. Esculentus*, Linn. Norway. English Channel.

18. *E. Margaritaceus*, Lamk. Patagonia. California.

The specimen in this collection was dredged in 40 fathoms, at San Pedro, by W. J. Fisher.

19. *E. Norvegicus*. Norway. Mediterranean. Straits of Florida.

20. *E. Miliaris*. Norway. English Channel.

Genus TOXOPNEUSTES.

21. *T. Pileolus*, Agassiz. Panama. Gulf of California. Viti Island. Mauritius. East India Islands.

HIPPONŒ.

22. *H. depressa*, A. Ag. Gulf of California.

23. *H. variegata*, A. Ag. Sandwich Islands. Japan. East India Island. Viti Island. Red Sea. Mozambique.

This species is smaller than *H. depressa*, from which it is easily distinguished by the small size of the tubercles, by the absence of tubercles in the interambulacral and median ambulacral spaces between the ambitus and the abactinal pole, and by the coloring (usually violet) of those spaces.

Sub-order CLYPEASTRIDÆ.

This sub-order, intermediate between the regular Echini and the *Petalostichæ*, contains Echinoids with very low, flat tests, petaloid ambulacra, and anal opening detached from the apical system, so as to give, as in the *Petalostichæ* or Spatangoids, an anterior and posterior extremity. They differ from the Spatangoids in the possession of jaws, which are, however, much simpler than in the regular Echini, and articulate upon the auricles of the test,

instead of being held in place by a system of muscles. On the lower or actinal surface ambulacral furrows, crowded with small pores, and arranged irregularly, take the place of ambulacra. The ambulacra of the upper or abactinal surface are broader than the interambulacra.

Family CLYPEASTRIDÆ.

Echini with supports connecting the upper and lower floors of the test, either as pillars, walls, or radiating partitions.

ECHINOCYAMUS.

24. *E. pusillus*, Gray. Norway. Mediterranean. Azores. Florida.

CLYPEASTER.

25. *C. rotundas*. Panama. Gulf of California. San Diego.

The fine specimen from the Gulf of California, in this collection, is of a dark violet tint, which is its color when alive.

26. *C. scutiformis*. Red Sea. Philippine Islands. Kingsmills. Japan.

It has been my good fortune to examine a large number of specimens from Japan and the Pacific islands, obtained by various persons, among them W. Garratt and W. J. Fisher. These specimens, which are $1\frac{3}{8}$ to above 4 inches in length, all evidently belong to one species, and that species a *Clypeaster*, and not an *Echinanthus*, since there are no double floors or double walls. As the small specimens agree exactly with the *C. scutiformis* of Samk., it is evident that the larger ones are the adults of that species.

The three specimens in the collection measure respectively $1\frac{3}{8}$, $2\frac{5}{16}$, and $3\frac{13}{16}$ inches in longitudinal diameter, and $1\frac{3}{16}$, $1\frac{7}{8}$, and $3\frac{1}{4}$ inches in transverse diameter; but I have seen specimens exceeding the largest of these.

Family LAGANIDÆ.

Floors of test connected by walls running parallel to the edge; interambulacra extremely narrow.

LAGANUM.

27. *L. depressum*, Sess. Kingsmills. Viti Island. Philippines. Australia. Zanzibar.

Two small specimens, one of which measures $1\frac{3}{4}$ inch longitudinal diameter by $1\frac{1}{2}$ inch transverse diameter, appear to be the young of this species. They are from the Kingsmills. The partitions, forming a narrow belt of three or four concentric walls near the edge of the test, agree with *Laganum* proper, not with *Peronella*.

Family SCUTELLIDÆ.

Test extremely flat, frequently perforated with cuts or lunules. Ambulacral furrows of under side more or less branching; tubercles and spines of upper and lower surfaces differing in size.

ECHINARACHNIUS.

28. *E. excentricus*, Val.

This is the common cake-urchin of the Pacific coast, found at all points from Sitka to Monterey, and also at Kamtschatka. It is extremely common at the mouth of San Francisco Bay, where it lives in great numbers on the bar, on a bottom of sand and a little mud, at a depth of from five to seven fathoms. The district inhabited by it extends for a length of four or five miles, and the width of a mile along the west and southwest part of the bar.

29. *E. mirabilis*, A. Ag.

This author gives Japan as the habitat of this species; but it is also found in Alaska, as we have two fine specimens from the Shumagin Islands, presented by W. H. Dall.

30. *E. parma*, Gray.

A. Agassiz gives New Jersey, Labrador, Vancouver Island, Kamtschatka, and Australia as habitats of this species. Our collection contains some specimens from Hakodadi, Japan, presented by W. J. Fisher.

MELLITA.

31. *M. longifissa*, Mich. Panama. Gulf of California.

ENCOPE.

32. *E. Californica*, Verrill. Panama. Mazatlan. Gulf of California.

One of our specimens is curiously deformed anteriorly and posteriorly, so that its transverse diameter greatly exceeds its longitudinal diameter. The abactinal side is jet-black, with a velvety surface of small spines; but the actinal side, where the spines are comparatively large, is of a mouse tint.

33. *E. grandis*. Gulf of California.

Of this massive species we have one fine specimen, presented by W. G. W. Harford.

Sub-order PETALOSTICHA.

These *Echini* have no teeth; the anal system is separate from the apical; the ambulacra are petaloid; the test is less flat than in the Clypeastroids; certain parts of the test and spines are greatly specialized; and the radiate form is accompanied with an evident bi-laterality.

Family CASSIDULIDÆ.

Petalosticha without plastrons or fascioles, on which the spines are arranged differently to the rest of the test. They approach the Clypeastroids in many respects, but have no teeth, and in form simulate the regular *Echini*,

ECHINONEUS.

34. *E. cyclostomus*, Seska. Australia. Kingsmills. Zanzibar.

35. *E. semilunaris*, Gmelin. Florida. East India Islands.

RHYNCHOPYGUS.

36. *R. Pacificus*, A. Ag. Gallipagos. Panama. Gulf of California.

Family SPATANGIDÆ.

The actinal part of the test occupied by a plastron, with bare ambulacral avenues defining its sides. Other plastrons formed by fascioles or bands of crowded miliary spines. The combinations of the plastrons and fascioles, with the shape of the test and petals, are the principal characters used in distinguishing the subfamilies and genera.

MARETIA.

37. *M. planulata*, Gray. Kingsmills. China. East Indies. Mauritius.

LONENIA.

38. *L. elongata*, Gray. Red Sea. Australia. Philippines.

BREYNIA.

39. *B. Australasiæ*. China. Australia. Japan.

A very fine specimen, 3⅞ inches long by 3⅛ inches broad, probably presented by W. Garrett, from the Sandwich or Society or Kingsmill Islands, as I found it in company with the crustacea collected by him in those localities.

ECHINOCARDIUM.

40. *E. cordatum*, Gray. Norway. Mediterranean. Britain. Brazil. Florida.

AGASSIZIA.

41. *A. scrobiculata*, Val. Panama. Gulf of California.

BRISSUS.

42. *B. carinatus*, Gray. Society, Sandwich, and Philippine Islands. East India. Mauritius.

ADDITIONAL SPECIES.

[Acquired since date of List.]

ARBACIADÆ.

Arbacia Dufresnii, Agassiz. Patagonia. Chili. Navigator Islands. Locality of specimens in museum not known.

ECHINOMETRADÆ.

Colobocentrotus atratus, Brandt.

Specimens collected at the Paumotu Islands. Collected and presented by Capt. M. Turner. The species occurs also at Zanzibar, Java, and Sandwich Islands.

"Stimpson says that *C. atratus* is found at the Bonin Islands, adhering, simply by their suckers, to the perpendicular faces of rocks, exposed to the full fury of a Pacific Ocean swell. We must remember that the test of this genus forms, with its spines, a flat segment of a sphere, and that the close pavement of polygonal spines presents but little surface to the action of the water. The suckers of the actinal side are also very powerful and numerous." —*A. Agassiz*, "*Rev. Echini.*"

SCUTELLIDÆ.

Mellita testudinata, Klein.

Specimens from Galveston, Texas, presented by Mr. J. R. Scupham.

Dr. Blake called the attention of the Academy to investigations he is making in determining the molecular properties of minerals.

REGULAR MEETING, AUGUST 16, 1875.

President and Vice-Presidents being absent, Dr. Kellogg was called to the Chair.

Twenty-five members present.

Donations to the Museum: Silver ore from Nevada, from O. G. Leach. Thirteen specimens of ore, from Louis Lewis. Three specimens of ore, from L. Kaplan. Twenty specimens of Durangite, from Jos. T. Boyd. Five specimens of ore, from B. B. Minor. Four specimens of ore, from Geo. W. Dent; also from the same donor, nut gall, vegetable wax from the Andes, Orchilla from Mexico, Camel's hair from Calcutta, and Chinese envelopes. From A. J. Severance, specimens of rock, (core from Diamond Drill) from Oregon, California and Australia. Quicksilver ore from Santa Clara County, from A. K. Grimm. Silicified wood found 300 feet deep in Manzanita Mine, Nevada County, Cali-

fornia, from J. H. Wood. Fossil shells from Contra Costa County, and Cement Rock from same locality, donated by F. A. Walley. Silver ores from Jas. D. Stevenson.

A collection of forty-eight specimens of birds and mammals was presented by Professor Esmark, of the Royal University of Norway.

Dr. Kellogg spoke of his recent trip to Mendocino County. Among other things he had discovered there a true thorn—a California production.

Dr. Gibbons spoke of the remarkable climatic phenomena occurring last winter both here and in Europe.

REGULAR MEETING, SEPTEMBER 6, 1875.

Vice-President Edwards in the chair.

Thirty-four members present.

Joseph O'Connor, J. P. Moore and G. H. Sanders were elected resident members.

Wm. Barber and E. Pander were proposed for membership.

Donations to the Museum: From A. W. Crawford, twenty-four species of Marine shells from California, Mexico and New Zealand; ten species of fresh-water shells from the eastern rivers of North America; twenty-one specimens of minerals, Arizona, California and Colorado. Mr. W. J. Fisher presented fifteen species of Marine and Land shells from Japan. Charles Kaeding donated eight Ornithological specimens. Mr. Blunt presented specimens of *Procyon Hernandzii*, *Taxidea Americana* and *Mephites occidentalis*. Mr. F. Gruber presented specimens of *Cardinalis igneus*, *Cyanospiza cyanea*, *Leucostictea tephroctes*, and Japan thrush. Mr. G. W. Dent donated Kouri gum from New Zealand, and crude India Rubber from Mexico. J. G. Riley

presented ore from Lake County. Cornelius Cole presented fibrous Asbestos from Maryland and from Elko County, Nevada.

Mr. Edwards spoke of his recent trip to Mt. Shasta, particularly with reference to the California "Pitcher Plant," (*Darlingtonia Californica*) found in great abundance in that locality, as follows:

Darlingtonia Californica. Torrey.

BY HENRY EDWARDS.

Some time since I promised to bring before the notice of the Academy the few facts I had observed with regard to the remarkable pitcher-plant (*Darlingtonia Californica*), and by adding to them as much information as I could collect with reference not only to this species, but also to those allied to it in habits and structure, it is my hope that more extended observations may yet be made by some of our members upon this very singular product of the vegetable kingdom.

The *Sarracceniaceæ*, the family to which our *Darlingtonia* belongs, is one of the smallest known to botanists, containing only three genera and eight species. Its place in classification has been assigned between *Nymphæaceæ*, the family of the water-lily, and *Papaveraceæ*, that containing the poppies. Its geographical distribution is remarkable, the whole of the species of the family being confined to the American continent. Thus, the genus *Sarracenia* contains six species, all of them natives of the Atlantic States, and only one of them having at all an extensive range, viz.: *Sarracenia purpurea*, of Linnæus, which is found from lat. 48 N. to Southern Florida, and westward as far as Ohio. The remaining species *S. pittacina*, Michx., *S. rubra*, Walt., *S. Drummondii*, Croome, *S. flava*, Lin., and *S. variolaris*, Michx., are all confined to the Southern States; the last named species being probably the most abundant, the others being only met with in favored localities. According to Dr. Asa Gray, the genus was named by Tournefort in honor of Dr. Sarrazin of Quebec, who early in the present century forwarded a description of the best known species, viz., *S. purpurea*, to Europe. Since the time of its discovery, plants have constantly been forwarded to England and to the Continent, and now very many of the greenhouses of the old world boast the possession of our pitcher flowers. Another genus, *Heliamphora*, of Bentham, contains but one species, *H. nutans*, Benth., a native of boggy places in British Guiana. It is remarkable in its family for the scape containing sometimes five or six nodding, blush-white, or rose-colored flowers; those of the other genera being solitary, and mostly dull yellow, or purplish in color. The remaining genus, *Darlingtonia*, is a native of this State, and the only one of the group found west of the Rocky Mountains. It contains but one species, *D. Californica*, the subject of our present consideration.

This remarkable plant was first described by the late Dr. Jno. Torrey from specimens forwarded to him by I. D. Brackenridge, Assistant Botanist to the

United States Surveying Expedition under Captain Wilkes, in 1842, who detected it growing in a marsh bordering a small tributary of the Upper Sacramento River, a few miles above Shasta Peak. Dr. Torrey, in his description, which will be found in the "Smithsonian Contribution to Knowledge, Vol. VI, 1853," says:

"Owing to the lateness of the season (it was October), the flowers had passed, and not even a single seed-vessel was found, but only the leaves and tall scapes, with the remains of a single capsule. The leaves, however, were so peculiar that no doubt was entertained of the plant being either a *Sarracenia*, or a near ally of that genus. Without the flowers, nothing further could be determined respecting it; but, from the bracteate scape and deeply parted lamina of the leaves, it seemed more than probable that it was distinct from *Sarracenia*. Long had I been hoping to receive the plant in a more complete state, when it was at last brought to me by my friend, D. G. W. Hulse, of New Orleans, who found it in flower in May, 1851, in the same region, and perhaps in the very spot in which it was discovered many years before by Mr. Brackenridge. The plant proves to be generically distinct from *Sarracenia*, as well as from the genus *Heliamphora* of Bentham; and I take great pleasure in dedicating it to my highly esteemed friend, Dr. Wm. Darlington, of West Chester, Pennsylvania, whose botanical works have contributed so largely to the scientific reputation of our country. The genus dedicated to the veteran botanist by De Candolle has been reduced to a section of *Desmanthus* by Bentham; and a California plant, from an imperfect specimen of which I had recently indicated a genus under that name, proves to be only a variety of *Styrax*."

It may be well to add to this interesting note of Dr. Torrey, that *Darlingtonia* differs generically from *Sarracenia* by the forked blade of the leaf, and by the shape of the stigma. The flower of the former is stated to be, "when fully expanded, about two inches in diameter; the calyx consists of five straw-colored acute sepals; the petals, of a like number, and pale in color, are narrowed and concave at the apex and broad below; the twelve to fifteen stamens are nearly hidden by the projecting ovary, which is top-shaped, slightly five-angled, and crowned by a short style, with a five-lobed stigma. The fruit is a five-celled capsule, with numerous seeds." I may here remark that, though the flower is said by Dr. Torrey to be nodding at the apex of the stalk, I did not find it so. In August last, when I first met with the plant in the neighborhood of Mount Shasta, the flowers had become perfectly erect, and most of the capsules had burst and discharged their seed. It struck me that this may be owing to a careful provision of nature, which afforded the plant, as it became erect in ripening, an opportunity of spreading its seeds to a greater distance than it could do if the flower continued in a drooping position. The seeds themselves are armed at their extremity with small bristles, which cause them to adhere to the *Sphagnum* and other bog plants of their habitat, and thus secure them against being washed away by any excess of water in the bogs in which the plant has its home. Interesting as the flower of *Darlingtonia* is, however, it yields in general attractiveness to the leaves, which are not only peculiar in form and structure, but perform one of those curious functions in nature, the object of which we can by no

means clearly understand, but which are none the less calculated to excite our wonder and admiration. Viewed from a little distance, a growth of *Darlingtonias* presents a most beautiful and singular appearance, having a fanciful resemblance to a number of yellow hooded snakes, with head erect, in the act of making the fatal spring. I may here observe incidentally, that *caput-serpentis* would have been an appropriate specific name. The bright yellow, and, in some cases, almost orange color of the hoods, also suggests a growth of giant orchids; and it is probably, in some degree, to this resemblance to a flower that the leaves are indebted for their faculty of entrapping insects, which is the most remarkable feature of the plant. The leaf, which is tubular for the whole length, sometimes reaches the height of three feet six inches, and has a peculiar twist in its stem, always bending in one direction, the course of this twist being marked on the edge of the leaf by a winged membrane, increasing in width from the base to its termination at the mouth of the pitcher. The apex of the leaf is a large, swollen, reticulated hood, sometimes, in well grown plants, as large as a man's fist, divided in front and above the opening into two lanceolate lobes, which are curved downwards, and are strongly marked with purplish veins, these colored veins being also continued on the inner surface of the tube for about one-third of its distance. For more than half its length the interior of the tube is smooth and marked with semi-transparent reticulations, but from that distance to the base it becomes more opaque; and it is furnished with a closely set series of fine, spinous hairs, laid thickly against the walls of the tube, and all pointing downwards. Examined under the microscope, these hairs present no trace of barbs or hooks, but are simply sharp points, hardened and toughened towards their extremity.

The whole of this structure appears to be admirably adapted for the singular habit of ensnaring insects, which is so wonderful a feature of the economy of *Darlingtonia* and its allies. The insects may easily be led to mistake the brightly colored hood for a flower, and wandering into its treacherous recesses, find a smooth passage at the top of the tube lighted by the reticulations of the leaves, and excreting a slight amount of viscous substance, slightly sweet, and of the consistence of honey. Passing along this passage, they at last reach the bottom, find on attempting to retrace their steps that escape is impossible, and their wings becoming useless by contact with the viscid discharge from the walls of the leaf, and the moisture secreted at the bottom of the tube, they sink to their death in large numbers, the tube sometimes being filled to the depth of from six to seven inches with the remains of insects in the various stages of decomposition.

I do not attempt to speak authoritatively upon the subject, but I am inclined to think that no process similar to that of digestion goes on within the plant, but that the fluid mass derived from the decay of the imprisoned insects descends through the tube into the earth, and is taken up by absorption, through the roots, thus acting as a kind of liquid manure. It is true that in the dead leaves the hard integuments of insects, such as the elytra of beetles, and the bodies of wasps and hornets are to be found undecayed, but this may be because the liquid secreted by the plant is not powerful enough to cause decomposition of these parts before the plant itself decays. An analysis of

the fluid found within the tube, and of the leaf itself, would be of service to decide this point, but the structure of the plant prevents the rejection of particles not needed for its subsistence, as is the case with *Drosera*, *Utricularia*, and *Dionea*. It would appear that all order of insects are lured to the fatal embrace of *Darlingtonia*, and it astonished me to find that I could recognize so many species among the remains I examined. I cut open and carefully studied the contents of about forty tubes in all, and found that I could distinguish no less than forty-three species of insects, which I am able to tabulate as follows:

Order—*Coleoptera:* Genera—*Platynus*, *Serica*, *Coccinella* (2), *Hippodamia;* number of species, five.

Order—*Hymenoptera:* Genera—*Apis*, *Vespa*, *Ichneumon;* number of species, three.

Order—*Orthoptera:* Genera—*Acrydium* (2), *Tettix* (?); number of species, three.

Order—*Neuroptera:* Genera—*Mantispa*, *Myrmeleo*, *Agrion;* number of species, three.

Order—*Diptera:* Genera—*Tipula*, *Musca*, *Tachina*, *Asilus;* number of species, twenty or more.

Order—*Lepidoptera:* Genera—*Colias*, *Agrotis*, *Botys;* number of species, three.

Order—*Hemiptera:* Genera—*Notonecta*, *Reduvins* (?) (2); number of species, four.

Order—*Arachinda:* Genera—(unknown); number of species, two.

It is probable that this list could have been very considerably increased, but I was sufficiently convinced that all the insect orders were represented in the seething pot of the *Darlingtonia's* kitchen. The greenest tubes—those which are of comparatively recent growth—seem to be less attractive to insects, and I have always found the largest quantity of remains in those which are richest and deepest in color. Across the opening of the hood a small spider, seemingly allied to the genus *Thomisus*, spins its web, as if aware of the attractive nature of the plant, and conscious that its own prey could be thus easily captured. I have also invariably found among the mass of decay some living larvæ of a small dipterous insect, probably one of the *Tipulidæ;* and I observe that a similar circumstance has been recorded by Dr. I. F. Mellichamp of Bluffton, North Carolina, with reference to the pitchers of *Sarracenia variolosa*. Dr. Mellichamp's paper is so interesting that I make no apology for transcribing the following: "The base of the tube of *S. variolosa* secretes a watery fluid, which is not sweet nor odorous, but which proves quickly fatal to all insects that fall into it. The whole inner surface is covered with very minute, closely appressed prickles, perfectly smooth, and pointed downwards, which render it impossible for an insect to ascend by walking, even when the leaf is laid nearly horizontal. Within the somewhat dilated rim of the tube, there is a band half an inch in width, dotted with a sweet secretion, attractive to insects, but not intoxicating. This also extends downwards to the edge of the outer wing to the very ground, thus alluring many creeping

insects, and especially ants, to the more dangerous feeding ground above, where once losing foothold, it is impossible to regain it. Even flies escape but rarely, the form of the tube and lid seeming to obstruct their flight. As the result, the tube becomes filled to the depth of some inches with a mass of decaying ants, flies, hornets and other insects.

Within this there is always found a white grub feeding upon the material thus gathered, perhaps the larva of a large fly which has been observed to stand upon the edge of the tube, and drop an egg into it. Soon after the full development of the leaf, the upper portion becomes brown and shrivelled, which is due to still another larva, the young of a small moth, which feeds upon the substance of the leaf, leaving only the outer epidermis, and works its way from above downward, until in due time it spins its cocoon, suspending it by silken threads just above the surface of the insect debris at the bottom. The whole forms a series of relationship, and an instance of contrivance and design, the full purport of which is by no means fully understood." It will thus be seen that the same general habit obtains through the whole family of *Sarraceniaceæ*, though in details there are to be found differences in some striking particulars. In the first place, it is more than probable that the liquid secreted in the base of the tubes of *Sarracenia* is pure water, deposited from the atmosphere,* but the shape of the hood in *Darlingtonia*, which totally covers the opening of the tube, suggests some other cause for the presence of moisture at its bottom. This liquid, which is *Sarracenia*, is said by Dr. Mellichamp to be inodorous, is in our California plant most disgusting in its smell, and after handling a number of specimens of the tubes, it is necessary to use some disinfectant like ammonia or chloride to remove the disagreeable ordor. The larva found among the debris of *Sarracenia*, though belonging undoubtedly to the dipterous order, is nevertheless of a totally different genus from that found in *Darlingtonia*, as the latter are very minute, almost microscopic in size, though it is possible that more than one species may yet be discovered. I should also state that I found no ants whatever in the tubes of *Californica*, though subsequent observations may yet add to our knowledge the fact of their presence among the victims. Nor can I find any trace of a lepidopterous larva, like that noted by Dr. Mellichamp, which was probably the early stage of some species of *Tortrix*. Careful and continued observation will, however, doubtless bring to light many new facts connected with the economy of this singular plant. The stems of *Darlingtonia* are generally marked with some ferruginous blotches, which are due to the presence of a small fungus, which has been examined by our fellow-member, Dr. Harkness, and by him pronounced to be a new species of *Trichobasis*. Dr. Harkness, while intending to publish the results of his observations, permits me to add that he proposes to name the species *Trichobasis Darlingtoniæ*. The Indians of the district around Mount Shasta are well acquainted with the fly-catching habit of *Darlingtonia*, but I regret to say that I could not discover their native name of the plant, nor could I learn that they ascribe to it any medicinal proper-

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* NOTE—I have since been assured by Dr. Mellichamp that the liquid is by no means pure water, but an excretion of the plant itself. H. E.

ties. I was the more surprised at this, as I was aware that to *Sarracenia purpurea* is credited a large amount of virtue in cases of small-pox, a paper on its efficacy in this terrible disease having been contributed to *Land and Water* in 1871, by Captain Hardy of the Royal Artillery, who spent some time in Newfoundland, and who derived his knowledge of the value of the pitcher plant from the Indians of that region. The portion of the plant used is the root, which has been introdnced into England, and is sold there at the high rate of 28 shillings per pound. I mention this fact as it is more than probable that our own species may possess some hidden virtue which may prove equally as valuable to mankind.

I may state that *Darlingtonia*, though certainly a local plant, is by no means rare in the districts in which it is found. The locality nearest to San Francisco in which it has been detected is in the foothills of the Sierra, about 10 miles from Nevada City. It is, however, most abundant in the region about Mount Shasta, where it may be found in at least thirty or forty places within a radius of fifteen or twenty miles. It grows in boggy spots on the sides of mountains, and particularly about those known to hunters as "deer licks," which are abundant along the banks of the Upper Sacramento and its tributary streams. Extreme altitude is not necessary to its growth, as it is found from 1,000 to 5,000 feet. Mr. Robinson, of the *Field* newspaper, who visited this country a few years ago, chiefly for the purpose of observing the plant in its native haunts, states that it is by no means difficult of cultivation, and that it is "best treated by being grown in a soil of peat or peat and chopped sphagnum, kept wet, not merely moist, the pots or pans to be placed on a wet bottom—frame or cool-house treatment being the best in winter, warm greenhouse or temperate stove in summer."

In concluding these imperfect remarks, perhaps I may be permitted to hope that they may be the means of directing more perfect attention to this remarkable plant, which must always be regarded as one of the many vegetable wonders of California.

Regular Meeting, September 20, 1875.

In the absence of the President and Vice-Presidents, Charles Wolcott Brooks was called to the Chair.

Fifty-two members present.

Donations to the Museum: From L. Higbee, Los Angeles, specimen from an artesian well 189 feet deep. From Henry Chapman, Fossil Shells—cretaceous—from Alameda County. From F. A. Walley, Fossil Shells found in sandstone in Marin

County. From C. C. Coleman, Ramie fiber. From C. D. Gibbes, fibrous Asbestos and Manganese. From Star & Mathison, Plumbago from Ceylon, Antimony from Nevada, and "Regulus" from San Francisco. From Charles Reed of San Mateo, Argentiferous Galena from Sacramento mine, San Mateo County, Gold ore from San Gregorio Creek, and Indian implements (stone) from Redwood City. From G. W. Dent, two Lizards from China as prepared for medicine by Chinese. From J. Daniels & Co., Scotch Granite. From Holmes & Dawson, Suisun Marble. From Fred. MaCrellish, Sulphur from Sulphur Banks, Humboldt County, Nevada.

Mr. Williamson read a paper on "Fish Culture."

T. J. Lowry read a paper describing a new method of determining positions in Hydrographic Surveying, as follows:

A New Method of Determining Positions of the Sounding-Boat—Application of the Two-Point Problem to Hydrographic Surveying.

BY T. J. LOWRY.

This is called the age of practice—the inventive age. And, undoubtedly, the prevailing tendency of the science of this age is synthetic. The problem it places before itself is not so much to discover isolated truths as to combine, to harmonize, to generalize, to utilize those already found out. Instead, then, of indulging in ineffectual wanderings in the labyrinths of analytics, let us pause for a moment in the field of synthetical geometry—where Euclid, Newton, and Bessell deigned to labor—and see if there are not "seed fallen by the wayside, among rocks and in stony places," which we may cause to yield profitably for the exact arts.

The increased traffic and travel on the rivers, bays, lakes, gulfs, and oceans, within the last half-century, have made the accurate mappings of the topography of these water-basins of the earth commercial, national necessities. The civilized nations of Europe have long felt and acted upon these demands of navigation and commerce; nor has the United States been left in arrears, for already has she executed a system of hydrography—even extending her researches into the Gulf Stream and kindred inter-ocean rivers—securing results which challenge at once the wonder and admiration of the scientific and navigating worlds.

The hydrographic chart is the lamp to the navigator's path over the intricate windings of the waters of the earth; the revealer of rocks, shoals, reefs, hidden beneath smiling seas, and therefore the secret to a safe navigation, and hence successful international commerce. Does it not, then, gentlemen, behoove us, as a scientific body, to make all possible improvements in the theory and practice of hydrography?

Hydrographic surveying was reduced to a real, a practical entity, by the discovery of the three-point problem, by Pothenot. This problem being wide in its application, accurate in its determinations, and yet most simple in its graphic solutions, has, from the first, stood the grand central truth of practical hydrography. But to fix a position by this problem is required, on three known points, two connected angles observed simultaneously. And with only two known signals in sight it utterly fails to fix a position. Now it is to remedy these defects, to fill up these gaps left open by the three-point problem, and thus enable the hydrographer to determine his position under a wider range of contingencies, that I propose the application of the two-point problem to hydrographic surveying.

In determining positions of the sounding boat, equal in accuracy, and second only in point of usefulness to the three-point problem, is the two-point problem, which, with its many varied phases and fewer known points, greatly increases the hydrographer's capability of ascertaining his position under every contingency. This problem determines any two points on an unknown range (or inter-range) if at each of these points are measured the (two) angles contained by this range and two known signals. The boat's path may either coincide with the range or inter-range (see Fig. 1), or cross it at two or more points (as shown in Fig. 2). In the first case we can fix the position of the boat at any two or more instants by "angling" at those instants on two known signals ("*A*" and "*B*"), and the undetermined range. When the boat only crosses the range at two or more points, its position can be fixed by this problem only at these points, and that, of course, by "angling" at the very instants of crossing the range. The better conditioned the quadrilateral, formed by the two known points and the two places of observation, the better will these places be determined; and will be wholly undetermined when the right line, through the places of observation, prolonged, traverses either one or both of the observed signals.

Where ranges are ready prepared for us—as when adjacent to cities with their flag-staffs, chimneys and spires, or where the country rises into highlands and mountain peaks back from the shore—the determination of a boat's position by this problem is alike easy and expeditious. And even where nature does not offer such ready prepared facilities, we can readily supply them, where the water is comparatively shallow, by dropping temporary spar buoys (a pole with rock to one end). One buoy will furnish a stern range, if we have another visible stationary object directly astern, or an inter-range if directly ahead. But if there is no such stationary object visible, then continue the line of soundings, and drop further along a second buoy, and at the same instant measure the angles contained by two known signals, and the first buoy, and from another point on the range of these buoys, catch the angles between this range and any two known signals, and the soundings are determined. By cutting on a third point on shore, from two or more of these determined positions of the boat, it can be fixed in position without visiting the shore or even stopping the sounding boat; other signals may thus readily be substituted for those swept away by storms, etc.

The buoys thus dropped being determined fixed points, may serve as signals for carrying a hydrographic triangulation further on out off shore. This

FIG. I. FIG. II.

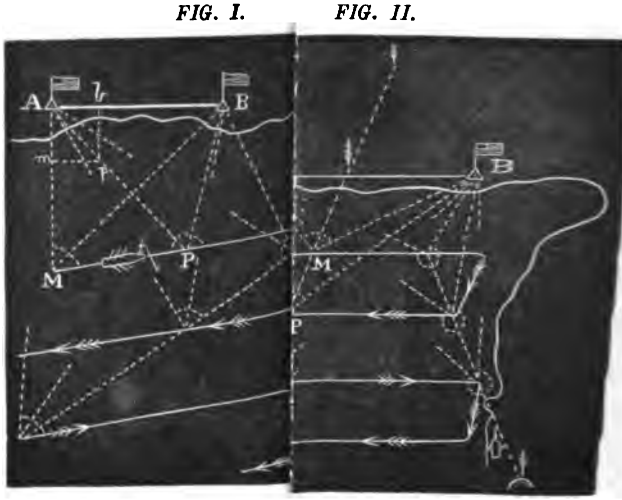
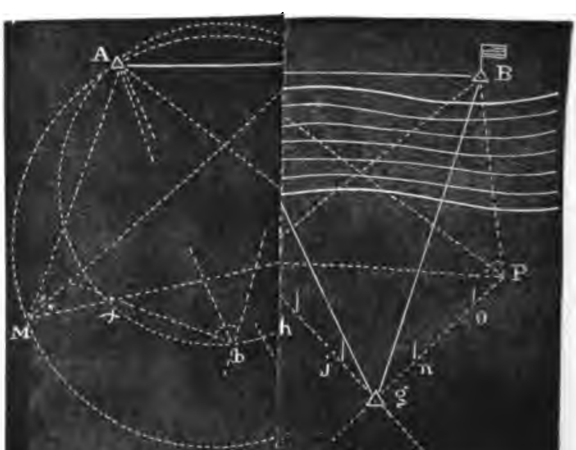


FIG. III. FIG. IV.



problem will thus prove most useful in the survey of off-shore shoals and reefs, and in the location of buoys, where only two signals are in sight. And it may, moreover, be found especially serviceable in the surveys of those large shallow bodies of water which abound along the Atlantic and Gulf coasts of the Southern States, where the low shores and hazy atmosphere render it extremely difficult to keep three signals in sight.

The geometrical construction of this problem is accomplished in the following obvious manner: On $A\ B$, in Fig. 3, describe segments containing respectively the angles $A\ M\ B$ and $A\ P\ B$, draw the chord $B\ y$, to cut off segment, $B\ A\ M\ y$, containing the angle, $B\ M\ y$, and another chord $A\ x$, cutting off segment, $A\ B\ P\ x$, containing the angle, $A\ P\ x$. The points. x and y, will be in the same right line with M and P; join $x\ y$, which produce both ways till it cuts the circumferences in M and P, which will be the required places of observation.

The triogmetrical analysis furnishing the readiest means for computing this problem, is that known as the indirect. Thus, let any number, as 10 or 100, represent $m\ p$, in Fig. No. 1. Then in the triangle, $A\ m\ p$, are known the angles, $A\ m\ p$, $(=A\ M\ P)$, and $A\ p\ m$ $(=A\ P\ M)$, with side, $m\ p$, from whence $A\ m$ may be found. In the triangle, $m\ p\ b$, are known angles, $m\ p\ b$ $(=M\ P\ B)$, and $b\ m\ p$ $(=B\ M\ P)$, with $m\ p$, to find $b\ m$. Now, in the triangle, $A\ m\ b$, are known angle, $A\ m\ b$ $(=A\ M\ B)$, and the sides, $A\ m$ and $b\ m$, from which $A\ b$ may be found. And now, from the similarity of figures, $A\ b : A\ B :: m\ p : M\ P$, and by like proportions any other of the required sides may be found.

The two-point problem finds a ready graphic solution by laying off each set of observed angles on a separate piece of tracing paper, and shifting these two papers until the lines of sight traverse each its proper point, then prick the vertices of these angles on to the sheet, and they are (M and P) the required points of observation.

But a neater graphic solution, based upon very obvious geometrical considerations, is found in the three-arm protractor: with the angles measured at M (see Fig. 3) set off on the proper limbs of the protractor, cause its left and middle arms to traverse A and B, and draw a line along its right arm. Shift center of protractor to some point, as m—taking care to keep A and B bisected by left and middle arms—and draw another line along right arm and y, the point of intersection of these lines, will be a point in the right line through the places of observation, M and P. Now, set off the angles observed at P on the corresponding limbs of protractor, bisect A and B with the fiducial edges of the middle and right arms. Draw line along left arm; shift center of protractor to some point as p, and with middle and right arms still bisecting A and B, draw line along left arm, and x, the point of intersection of these two lines, will be a second point in right line through M and P. Draw an indefinite right line through x and y. Now, with the angles observed at P on the protractor, cause its middle and right arms to traverse A and B while the true edge of its left arm coincides with line through x and y; dot its center, and we have P, one of the places of observation; and, in like manner, find M, the other place of observation.

These are the solutions of the case of this problem where only two known signals are involved. There are, however, two other cases: First, where from one position of the boat signals *A* and *B* are visible, but from the other only *B* and *C* are seen; here the boat's positions are equally well determinate, and the geometrical construction and graphic solutions are the same as above given—but the trigonometrical analysis varies slightly (see Narrien's Geodesy). And in the second case, where first position of boat sees only signals *A* and *B*, and its second position only *C* and *D*, these positions are still determinate, and the graphic solutions and geometrical construction are identical with those already given, but the trigonometrical analysis is different, as shown by the writer on page 19, vol. 2, of *The Analyst*.

The two-point problem may, moreover, be found most serviceable in restoring lost stations. Suppose the case illustrated in Fig. No. 4—where (the surface mark of) station *G* is lost and its restoration is desired. Having an approximate idea of the position of the lost station, *G*, choose two such points, *M* and *P*, as make at once the quadrilateral, *A B P M*, and the triangles, *A M G*, *B P G* and *G M P*, "well conditioned." Then at *M* and *P* successively measure the angles *B M A*, *B M P*, *A P B* and *A P M*, and find—either by construction or computation, as above shown—the unknown sides and angles of the quadrilateral, *A B P M*. Now from the original triangulation are known the sides *G A* and *G B*, and angles *G A B*, and *G B A*; and the angle *G B P*=*P B A*—*G B A*. We hence have two sides, *G B* and *P B*, and included angle, *G B P*, to find *P G* and angle *B P G*, the distance and direction of the lost station, *G*, from the point, *P*. But if no linear measure is available, then mark the direction of *G* from the point, *P*, by range poles, *n o*, and shift the theodolite to *M*. Find angle, *A M G*, in like manner to that which found angle, *B P G*. Then cover *A* with telescope, turn it in azimuth equal to angle, *A M G*, and mark the direction of its line of sight with poles, *i h*. We then have marked out two ranges, *i h* and *o n*, intersecting at "the lost station," *G*.

And equally applicable when on land searching for a lost station with three signals in sight, is the maneuver so well understood in hydrography of taking from the sheet the angles subtended by the three signals at the lost station, setting them off on two one-angle, or one two-angle sextant, and shifting the position of the observer till the images of these signals coincide in his horizon glass, when he will be close on the "lost station."

Dr. Blake read the following:

On the Results of Glacial Action at the head of Johnson's Pass, in the Sierras.

BY JAMES BLAKE, M. D.

In a recent trip in the Sierras, at the head of the south fork of the American River, I met with some evidences of glacial action which I think are worthy of being recorded as furnishing some indications of the character of the climate during the middle part of the glacial epoch. The head of the valley

of the south fork of the American River terminates in Johnson's Pass, a gap in the western summit of the Sierras, about 7,500 feet above the level of the sea. The break in the mountains extends for about a mile and a quarter from north to south, and is nearly level. The upper part of the American Valley, for three or four miles, rises by a gentle slope up the pass, and is from half a mile to a mile wide, with a flat meadow bottom of mountain meal, bounded on each side by moraine blocks, lodged against the sides of the mountains. The head of the pass terminates by a pretty steep escarpment which forms a part of the western boundary of Lake Tahoe Valley, lying about 1,000 feet below. The south side of the American Valley, near the pass, is formed by a mountain about 9,000 feet high, the face of which, opposite the head of the pass, suddenly changes its direction, turning to the south to form the west wall of the southern termination of Lake Valley. To the north, the pass is separated from Echo Lake Valley by a vast bank of moraine matter, which formed at one time a lateral moraine of Echo Lake glacier, but which has been subsequently increased and gradually sloped off towards the valley by the bed of the glacier being forced up over it during the middle of the glacial epoch. As this Echo Lake glacier has evidently been an important element in causing the glacial action at the upper part of the American Valley, a short description of its old bed will be useful. The Echo Lake Valley is about four miles long, running in a direction southeast, northwest, and terminating towards the northern or upper end in a perfect amphitheater, surrounded by high peaks. The chord of this amphitheater or cirque measures probably two miles and a half, affording ample area for the formation of a vast glacier. The valley abuts to the southeast against the western wall of Lake valley at the north termination of the depression which forms Johnson's Pass. The bottom of the valley is now occupied by two lakes, one of which is a mile and three-quarters long, and a quarter of a mile broad, with a depth of water of 150 feet. The other, or upper lake, is smaller and not more than thirty-five feet deep. They are separated by a belt of rock a few yards broad, in which the granite presents a more schistose character. The rocks on the border of the lake show evident marks of glacial action to a height of 400 feet above its level, and moraine matter has been deposited fully 200 feet higher, so that the Echo Lake glacier must have been between seven and eight hundred feet thick. During the earlier part of the glacial epoch it was precipitated over an almost perpendicular cliff, a thousand feet high, into Lake Valley, and whilst pursuing this course it piled up a vast moraine on its southwest border, the upper end of which terminates at a height of about 300 feet above the level of the lake. This now forms the divide between Echo Lake and the American River Valley. The true nature of this embankment is well shown where it terminates above Lake Valley, and also at its upper part where it joins a spur of the mountain, but the greater portion of it has been so completely covered in by detritus, under the form of mountain meal, and the few rocks that appear on the surface are so completely rounded and polished that but for the appearances at the upper and lower ends, its true character as a lateral moraine would not be suspected.

As before stated, the lower end of Echo Lake Valley terminates at the edge of the escarpment forming a portion of the sides of Lake Valley, and it

was evidently over this escarpment that the glacier flowed during a long time; but as Lake Valley itself became filled with ice, and its glacier reached to the height of six or seven hundred feet above the side of the valley at Johnson's Pass, Echo Lake glacier could no longer escape into the valley, but was deflected with the vast ice stream from Lake Valley down the valley of the American River. In taking this new direction, the bed of the glacier was forced up over what had been before its lateral moraine, grinding off the angles of the rocks, and filling up the interstices with mountain meal, so that the moraine, particularly towards the American Valley, presents a gentle slope, with only an occasional boulder visible. The Echo Lake side of the embankment is much steeper, and a few feet below its crest has a ridge of moraine rocks, with perfectly sharp edges. This ridge is separated from the top of the embankment by a shallow depression, a few yards broad. These rocks had evidently been deposited on the ridge of mountain meal as lateral moraine, after the Lake Valley glacier had retreated below the level of the pass so that the Echo Lake glacier could resume its former course.

On the south side of the head of the pass, a large quantity of moraine matter has been deposited from the glacier coming in from the south end of Lake Valley. Until Lake Valley itself had been filled with ice up to the level of the pass, the moraine matter from this glacier would be deposited in the valley; but as soon as the ice reached the level of the pass, a large moraine was deposited, extending nearly half a mile across the head of the pass, and then bending to the west down the American Valley. This moraine, at the point where it leaves the mountain, is apparently about four hundred feet high, and a quarter of a mile thick at its base, and is composed of large masses of granite, with their edges quite sharp. Even a mile below the head of the pass, the moraine is 150 feet high and 400 feet thick, here forming the north wall of the basin of Andrean Lake, a small lake about 300 yards long and 250 broad, situated directly at the foot of the mountain, on the south side of the American Valley. The rocks at this part of the moraine are more or less rounded, and the interstices filled with the finer detritus. The middle of the valley, near its head, and for some distance down, is covered with a thick deposit of mountain meal, interspersed with large boulders, which have evidently been glaciated from the northeast. This has been opened to the depth of twenty feet without reaching the country rock. It is completely unstratified, and contains a few boulders, well rounded, but not very large, at least such was the case in a cut and tunnel made in the deposit towards the north side of the valley. In making the cut, a layer of gravel was found about eighteen inches from the surface; it was about two inches thick, and composed of rounded quartzose and other pebbles, and must have been derived from some disintegrated conglomerate beds. The only probable source of this thick deposit of finer detritus is from the bed of Echo Lakes, and the glaciated mountains to the northeast of the lower lake. It is found forming the bed of the American Valley for three or four miles from the summit of the pass, but beyond this point it gradually disappears, so that, at six miles from the summit, it was found extremely difficult to find any dirt to fill into the crevices between the rocks, when making a road through the valley.

Such is a general sketch of the results of glacial action at the head of American Valley—results which could only have been produced under totally different climatic conditions than a mere diminution of the mean annual temperature. It is evident that the formation of the large moraine across the head of the pass, from the glacier coming from the head of Lake Valley, could only have taken place when the surface of the mountain at the head of the pass was uncovered by snow, at least during a part of the year; or, in other words, at the time that the glacier in Lake Valley had attained a thickness of more than a thousand feet, there was no permanent glacier at the head of the pass. At present, the snow by the end of the winter is from ten to twenty feet deep at the head of the pass, and from four to eight feet deep in Lake Valley, and it has melted in the valley six to eight weeks before it disappears from the head of the pass. With a colder climate, in which, however, the relative temperature of the summer and winter should be the same as at present, it is evident that long before the Lake Valley glacier had attained a thickness of one thousand feet, a glacier some hundreds of feet thick must have occupied the head of the pass, so that the moraine matter brought down by the southern tributaries of Lake Valley glacier could not have been deposited there, but must have been carried down the valley of the American River as soon as the Lake Valley glacier was thick enough to force the ice stream in that direction. The most probable climatic conditions under which such a deposition of moraine matter as is found at the head of the American Valley could take place are, a colder winter with a very heavy snow-fall, and a hot summer, during which the snow would be removed from the surface, even at an elevation of 7,000 feet, when not fed by glaciers. The gradual filling up of Lake Valley by ice, was the result of the many glaciers coming into it on all sides, as has been shown by Prof. J. LeConte, and which had their origin in mountains from 1,500 to 2,000 feet above the level of the pass. That these ice streams were pouring into Lake Valley when the head of the American Valley was comparatively free from ice, is proved, also, by the formation of the large lateral moraine, from Echo Lake glacier, on the north side of the valley. Another fact that would indicate the rapid disappearance of ice at the upper part of the American Valley during the height of the glacial epoch is, the comparatively slight longitudinal extension of the glaciers down the American Valley. Although there is undoubted evidence that in Lake Valley, and at the head of Johnson's Pass, the ice attained a thickness of six hundred feet above the level of the pass, yet the larger part of the terminal moraine matter has been deposited within six or seven miles of the head of the pass, and at an elevation of only 1,000 feet below the top of the pass. Now, the rapid disappearance of this American Valley glacier, fed, as it was, by the Echo Lake glacier, and also by the vast ice stream from Lake Valley, would indicate that it must have been exposed to a much higher summer temperature than prevails at present. The topographical formation of the American Valley would also favor the melting of the ice, as the valley opens directly on the heated plains of the Sacramento, and thus affords a channel for the hot air of the plains during the summer, and for the moisture-

laden air from the warmer ocean that probably existed far on into the glacial epoch.*

Should the facts above stated admit of the interpretation I have given them, it is evident that they are inconsistent with the views of those who regard the glacial epoch as the result of mere geological changes in the distribution of land and water. That these changes may have played a subordinate part in intensifying the influence of cosmical causes is probable, just as the immense outflows of volcanic rocks, covering so many thousands of square miles of our continent to the depth of 1,800 to 2,000 feet, must have exerted a great influence on the warmer climate of the Miocene. In fact, as I have before stated to the Academy, I believe the heated term of the Miocene is much more easily referable to geological causes than is the cold of the glacial epoch.

Without wishing to attach too much importance to the facts above stated, I think the evidences of glacial action at the head of Johnson's Pass are inconsistent with any other hypothesis than that, far on in the glacial epoch, cold winters, with heavy snow-falls, alternated with very hot summers; and also that, at the same period, there was no permanent ice-covering on the surface at an elevation of 7,000 feet above the sea, at least in these latitudes. It is, I think, only in such climatic conditions that the vast moraines at the head of Johnson's Pass could have been formed, particularly the embankment moraine on the north side of Andrean Lake. This moraine could not have been formed by a glacier pushing its end out into water, as Professor LeCompte has shown was probably the case with similar moraines in Lake Valley and Mono Lake. The only conditions under which the moraine on the south side of the American Valley could have been formed was, that the surface on which it rests was not covered by ice at the time the Lake Valley glacier had reached the level of the head of the pass. The glacier from the head of Lake Valley, by far the largest entering the valley, then deposited a lateral moraine, stretching some distance across the head of the American Valley. As the ice accumulated in Lake Valley, and began to deflect the Echo Lake glacier to the west, the glacier from the south end of the valley was also forced in the same direction, depositing its moraine where the surface was still uncovered by ice, and thus laying the foundation on which moraine matter subsequently lodged, as the rapidly melting ice during the summer months exposed its surface, even after the rest of the valley was permanently covered with ice.

The accompanying rough plan shows the deposition of moraine matter at

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*It is probable that a glacier has extended some distance down the American Valley below the point indicated, but this I believe to have been later in the glacial epoch, when the glaciers at the head of the valley were possibly diminishing in thickness, and after the great ice sculpturing in the higher mountains had been effected. I believe that it was in the earlier stages, and during the height of the glacial epoch, that the principal ice sculpturing took place, caused by the sudden and great alternations of temperature. The moraine matter deposited by the retreating glaciers was evidently very slight, in comparison with that deposited whilst they were increasing.

CALIFORN

the head of Johnson's Pass. I regret that, owing to an accident to my mountain barometer, I was unable to obtain exact hypsometrical measurements.

NOTE.—Since this paper was written, I have read Mr. Croll's work, *Climate and Time*, of which a large part is occupied in attempting to prove that during the glacial epoch the summers must have been colder than at present. As the grounds on which his argument is founded are more or less hypothetical, and his conclusions are, I think, inconsistent with the slight horizontal extension of the ancient glaciers, not only in the Sierras, but, as I have shown, also in the Puebla mountains, I must conclude that at least in this part of the earth's surface the glacial epoch was marked by cold winters with very heavy snowfall, and hot summers. The glacier coming from the south end of the Puebla range offers even a more marked example of slight horizontal extension than that at the head of the American Valley. This glacier had its origin in a valley six miles long and a mile broad, surrounded by peaks from 6,000 to 7,500 feet high, and which still retain snow on them during the whole year. At the height of the glacial epoch, this valley must have been filled by a vast glacier which escaped into the Puebla Valley, the latter valley being at an elevation of 4,600 feet above the sea; and yet under these circumstances the terminal moraine does not extend more than a mile and a quarter into the valley, although at its head, or near the foot of the mountain, it has probably a thickness of three hundred feet.

Mr. Lockington presented a communication drawing the attention of the Academy to the unhealthy condition of the building, suggesting remedies therefor, and that a committee be appointed to collect funds to improve the premises.

SPECIAL MEETING, SEPTEMBER 28, 1875.

Vice-President Edwards in the Chair.

Thirty-five members present.

By request of Mr. Edwards, General Colton, President of Board of Trustees, explained the object of the Special Meeting. He stated that the Board of Trustees had held a special meeting, at which Messrs. Felton and Hittel, Attorneys for Mr. Lick, were present. At this meeting Mr. Felton had read such parts of Mr. Lick's new deed, dated September 21, 1875, as were changed from the deeds of July 16, 1874, and September 16, 1875. The Trustees had informally agreed to the changes made by Mr. Lick. At the same meeting a deed was read, dated September 21, 1875, giving to the Academy, without any restrictions whatever, the property on Market Street, formerly deeded by

Mr. Lick to the Academy with certain restrictions, which are set forth in a deed dated October 14, 1873.

This was also informally accepted by the Trustees. Although the Trustees, under the law, and the Constitution of the Academy, are authorized to take charge of the property of the corporation and attend to its temporal affairs, the Board had thought it proper in a matter of this importance, to call a meeting of the Academy to endorse the action of the Trustees, or authorize them to act. It was explained that the new deed to the property on Market Street was eminently advantageous to the Society. Also that the new "Trust Deed" affected the Academy very slightly; and as all the other beneficiaries but one had signed, it only remained for the Academy to assent before sending it East for the signature of John H. Lick.

General Colton called on the Secretary to read the Resolution which the Board of Trustees proposed to adopt.

The Resolution was then read as follows:

Resolved, That the California Academy of Sciences do hereby accept the deed of James Lick, party of the first part, Richard S. Floyd, Faxon D. Atherton, Sr., Bernard D. Murphy, John H. Lick and John Nightingale, parties of the second part, and the California Academy of Sciences, the Society of California Pioneers, the Protestant Orphan Asylum, the Ladies' Protection and Relief Society, the Mechanics' Institute, and the Society for the Prevention of Cruelty to Animals, the City of San José, A. B. Forbes, J. B. Roberts, Ira P. Rankin, Robert McElroy, J. D. B. Stillman, Horace Davis, A. S. Hallidie, John Oscar Eldridge, and Lorenzo Sawyer, parties of the third part, which said deed is dated September 21st, 1875, and all the terms and conditions thereof, and do hereby release and discharge the said above-mentioned parties of the second part, in said deed named, from the performance of any of the duties imposed upon them by those certain deeds mentioned therein, dated respectively on the 16th day of July, 1874, and the 16th day of September, 1875, which are inconsistent with the terms and conditions of said first-mentioned deed.

Resolved, further, That David D. Colton (President) and Charles G. Yale (Secretary), of the Board of Trustees of this corporation, be and are hereby instructed to seal, sign, acknowledge, execute and deliver said first-mentioned deed in the name of this corporation, and with their names attached as such President and Secretary of the Board, and affix the corporate seal of this Academy thereto; and their acts in compliance with the above instructions are hereby ratified and confirmed as the act and deed of this corporation.

Resolved, further, That this corporation also accepts and receives that certain other deed from James Lick, party of the first part, to the California Academy of Sciences, party of the second part, dated September 21st, 1875.

By request of the presiding officer, Mr. Hittel, who was present with the new "Trust Deed" of James Lick, explained the changes which had been made in this, compared with the former one.

Mr. Hittel then read the deed to the property on Market Street, stating that it had been acknowledged by Mr. Lick. It is as follows:

JAMES LICK

TO

CALIFORNIA ACADEMY OF SCIENCES.

THIS INDENTURE, made and entered into this 21st day of September, 1875, between James Lick, of the City and County of San Francisco, State of California, party of the first part, and the "California Academy of Sciences," a corporation organized and existing under the laws of the State of California, and having its principal place of business at the said City and County of San Francisco, the party of the second part, witnesseth:

WHEREAS, Said party of the first party heretofore executed and delivered to the said party of the second part, a certain deed, dated on the fifteenth day of February, A. D. 1873; which said deed was duly recorded in the office of the County Recorder of the said City and County of San Francisco on the 20th day of February, A. D. 1873, in Liber six hundred and ninety-six (696) of Deeds, commencing at page three hundred and sixty-four (364), which said deed conveyed the following described piece or parcel of land in said City and County of San Francisco, State aforesaid, circumscribed by a line commencing at a point on the south-easterly line of Market Street distant one hundred and ninety-five feet south-westward from the south-westerly corner of Market and Fourth Streets, and running thence south-easterly and parallel with said Fourth Street, one hundred and ninety-five (195) feet; thence south-westerly at an angle of forty-five degrees to a point two hundred and seventy-five (275) feet from said south-easterly line of Market Street, which said last mentioned point constitutes the south-westerly corner of the hundred vara lot hereinafter mentioned; thence north-westerly and parallel with said Fourth Street, two hundred and seventy-five

(275) feet to said south-easterly line of Market Street; thence north-easterly and along said mentioned line of Market Street eighty (80) feet to the point of commencement. Said parcel of land being a portion of that certain lot of land laid down and commonly known upon the official map of said City of San Francisco, as one hundred vara lot number one hundred and twenty-six (126), with certain reservations and exceptions, and upon certain terms and conditions subsequent, all of which are fully expressed in said deed, reference to which said deed is hereby expressly made.

And Whereas, Said party of the first part afterwards executed and delivered to the said party of the second part a certain other deed dated on the Third day of October, A. D. 1873, which said deed was duly recorded in the office of the County Recorder of the said City and County of San Francisco on the Fourteenth day of October, A. D. 1873, in Liber seven hundred and eighteen (718) of Deeds, commencing at page three hundred and eighty-seven (387), which said last mentioned deed granted, gave, conveyed and confirmed to said party of the second part, all the lands and premises described in said first mentioned deed and above described, with certain reservations and exceptions, and upon certain other terms and conditions subsequent, all of which are fully expressed in said last mentioned or second deed, reference to which is hereby expressly made.

Now Therefore, In consideration of the premises and the respect and esteem said party of the first part has and bears to the said party of the second part, and the desire of the said party of the first part to further promote the prosperity of the party of the second part, and for the benefit of the Sciences in general, and in order to relieve the said party of the second part from all the terms and conditions subsequent, contained in said above mentioned deeds, or either of them, and from any and all terms, conditions and provisos, if any exist, the said party of the first part hath granted, given, confirmed, remised, released, and forever quit-claimed, and by these presents does grant, give, confirm, remise, release, and forever quit-claim unto the said party of the second part all the lands and premises described in said above mentioned deeds and hereinbefore described.

To have and to hold, all and singular, the premises hereby granted, given, confirmed, remised, released and quit-claimed

unto the said party of the second part and its successors, in fee simple, absolute, and without any conditions whatsoever.

In witness whereof the said party of the first part has hereunto set his hand and seal the day and year first herein above written.

(Signed,)

JAMES LICK. [L. S.]

[Recorded September 29th, 1875, at 20 minutes past 10 o'clock, in Liber 801 of Deeds, page 253.]

After the reading of the deed, the resolutions prepared by the Trustees and before read, was again read by the Secretary.

On motion of Dr. George Hewston, seconded by Charles Wolcott Brooks, the Resolution was adopted as read.

On motion, the Trustees were requested to convey the thanks of the Academy to Mr. Lick.

Regular Meeting, October 4th, 1875.

Second Vice-President in the Chair.

Forty members present.

Dr. G. F. Becker was proposed as a candidate for membership.

Donations to the Museum: Fourteen botanical specimens from Lower California, by G. W. Dunn. Tusks of Wild Boar from Santa Rosa Island, from W. G. Blunt. Rock from Choumagin Islands bearing specimen of *Terebratulina septentrionales*, dredged from forty fathoms by W. G. W. Harford. Fragments of ancient pottery, and one botanical specimen, from T. J. Butler, Prescott, Arizona. Insects from La Paz, from Dr. D. E. Hungerford. Hawaiian cotton, presented by C. C. Coleman. Silver ore from Arizona, by James Riley, Cerbat, Arizona. Two specimens of silver ore from Inyo County, from J. R. Frink. Sixty-eight specimens of minerals from various localities, from R. H. Sinton. Thirteen specimens of ore from White Pine, from T. H. Wells. Four specimens imitation marble on slate, and one specimen imitation porphyry on slate, from I. T. Milliken, San

Francicso. One specimen *Fontinalis antipyritica*, from R. K. Nuttall. Crustacean, from Dr. W. H. Jones, U. S. S. *Portsmouth*. Specimen of Manna found on Eucalyptus on State University grounds. Mr. Stearns said this was the first discovery of the kind on any Eucalyptus in California.

Dr. Blake read the following paper:

On Phylloxera.

BY JAMES BLAKE, M. D.

During the last week, I visited one of our extensive vineyards in Sonoma county, for the purpose of investigating, as far as a few hours would permit, the Phylloxera question, and as what I observed may be interesting to some, I will briefly state the results of my observations.

The proprietor of the vineyard was not certain, before I commenced my investigations, if any of his vines were affected. All he had observed was, that in separate patches about the vineyard the vines looked sickly. Some of them had died, and others were evidently dying; but, he stated, as he had noticed the same sort of thing for years, he did not attribute this to the new pest, although disease amongst the vines had never shown itself to the same amount as at present. In exposing the roots of one of the badly diseased vines, it was found to be covered by the insect. From two or three inches below the surface to as far down as the roots were traced (four feet), every crack and crevice in the outside bark of the root, was literally lined by Phylloxera. The vines in which this occurred were evidently in a dying condition. They had pushed out a few weakly shoots in the spring, which had not grown more than a few inches, and they had a few aborted bunches of grapes. They certainly would be dead next year. I noticed, in exposing the roots of the vine, that there were no superficial roots, at least, living. Some remains of dead roots were found on digging down, but nothing alive except the main roots. The lowest roots were not exposed, but from the escape of sap from the cut surfaces of the roots, it was evident that a certain amount of absorption was going on, and therefore that a large portion of the smaller rootlets must be uninjured. The roots of apparently a perfectly healthy vine were then examined. The plant had made quite a luxurious growth, some of the shoots being from six to eight feet long, and it had on it about fourteen pounds of grapes, which appeared to be ripening perfectly. The Phylloxera was found on the roots, but in much smaller numbers than in the other vine. Here they were confined to one or two cracks in the bark, and although pretty thick in these cracks near the surface, they were only met with in small patches at a foot under ground. These roots were followed down to a depth of more than four feet, at which depth a patch of Phylloxera was found, which consisted of not more than a dozen insects. About six inches above this was another patch, containing a larger number of individuals, and about every six or eight inches up the surface patches of the insect were

found, the size of the patches becoming larger as they were found nearer the surface. They were confined exclusively to a single longitudinal crack in the bark, at least from where the roots divided, about two feet beneath the surface. As before stated, they were found in patches, no insects being seen in the spaces between the patches. It was evident the crack in the bark of the root had offered a route by which the insect was gradually making its way down on the root. The patches undoubtedly indicated the stages by which the insect proceeded downwards, one insect from above passing over the intervening space and establishing a new colony, from which pioneers again started out to descend still lower. From the few insects found in the lowest patch, it is probable that this portion of the root had but just been attacked, and that not more than one generation had been born there. On some small roots that were given off about a foot from the surface, I found but one insect, and that near the main root. The soil of the vineyard was a gray clay, containing a considerable quantity of sand. It was derived from the disintegration of volcanic sedimentary rocks, and as it had been well ploughed and harrowed, it was quite fine and dusty. Under these circumstances, it is quite certain that the insect would not reach the roots of the vine through cracks and holes in the ground, as it is stated to do in France. Here there can be no doubt but that the migrations of the insect took place down the cracks in the outer bark, which not only afforded it a road, but also enabled it to introduce its sucker into the softer cambium, from which it derives its nourishment, and which it could not have reached through the whole thickness of the bark.

The fact of the infection of an apparently healthy vine, offers a serious prospect for the future wine prospects of the State, as it is impossible to say to what extent the disease already exists. It is probable that its effects only become manifest after it has already existed on a vine perhaps for years, and I think it likely that it will be found far more widespread than is now anticipated. I have, however, taken measures to ascertain this point, and I trust these remarks may call the attention of our wine-growers to the subject, and lead them to look for the insect amongst their apparently healthy vines. My own opinion is, that when a vine has once been attacked by the insect, it is merely a question of time as to when it will be killed, and the facts above stated show how hopeless it is to expect to be able to eradicate it when once it is established. In order to do this, we should have to expose the roots of the plant, and apply our remedies below the lowest point where the insect has penetrated. This is simply impossible. The only chance I see for successfully meeting the disease is, to endeavor to prevent its attacking vines that are already healthy, and I think this can most likely be effected in a manner that may not involve too much expense. There are two considerations in the history of the insect, which lead me to hope that this may be done. In the first place, I believe that at least in loose, pliable soil, that is kept well cultivated, the insect can only find access to the roots by crawling down the cracks in the bark, or in the crevices that are generally found about the root at the surface of the ground. I think it probable that some application, such as tar or train oil, that might be distasteful to the insect, might prevent its crawling down the stem; and surrounding the stem for a few inches with fine,

sharp sand, would not leave any cracks by which it could find its way beneath the surface. Again, the same means would be available for preventing its spreading. It appears that the way it spreads from one locality to another is, that at certain seasons of the year some of the insects become possessed of wings. These then come to the surface and deposit their eggs on the leaves of the vine, being often carried to some distance by the winds, and by this means alone it would appear that the diseased area becomes enlarged. Now, the same plan that would prevent the insect from descending to the roots would also still more effectually prevent these winged Phylloxeras from coming to the surface and extending the area of the disease.

Unfortunately, notwithstanding the attention that has been given to the subject in Europe, the natural history of the insect has been but imperfectly elucidated. Perhaps when we come to know more about it other means may suggest themselves for controling its progress. Up to the present time no remedy has been found for it, and if I may be allowed to express an opinion on the subject, it is because it has been looked for, I believe, in the wrong direction, by endeavoring to destroy the insect on vines that are already diseased. For reasons above stated, I believe this to be impracticable. The plan, I think, that will be found available, will be to give up the vines already attacked, and endeavor to preserve those which are not already infected.

Dr. Blake read the following paper:

On the Reimer Grape.

BY JAMES BLAKE, M. D.

In a communication I read before the Academy, last November, I related some analyses that I had made of the juice of different varieties of grapes, more particularly in relation to their fitness for making wine. Amongst the grapes anaylzed was one called the Reimer, in connection with which the following facts may be interesting: The day after I had received the grapes, the proprietor of the vineyard called on me, and on looking over the grapes that his manager had sent me, told me when he saw that there was a sample of the Reimer amongst them, that there was no necessity for me to analyze that, as he had given orders to have all the vines of that variety to be destroyed. As I, however, had already commenced the analysis, I went on with it, and discovered that this grape was possessed of what I considered the best properties for wine making. On making this discovery, I requested the owner of the vineyard to have some wine made from the juice of this grape unmixed with any other. This was done, and although it is yet rather early to judge of the wine, yet it certainly, at present, promises to be the best California made wine I have yet tested, and orders have now been given to preserve every shoot and sprout of the Reimer for propagation. It is certainly the most desirable grape for California that I have yet met with. It is a very free grower, and I believe even a more prolific bearer than the Mission grape. It will be seen by the analysis, published in the last volume of the proceedings,

that it is the variety that contains the most malic acid, and the wine made from it has certainly developed more bouquet than any California made wine of the same age I have yet tasted, thus supporting the views I then advanced as to the influence of malic acid in developing the aroma of wine. It would seem that the vinicultural mind is at last waking up to the value of malic acid in wine-making, as a comparison of the prices paid for the different varieties of grape, with the data furnished by my analyses, will show:

	Malic acid per cent.	Price in Napa Valley per ton.
Zinfindel	0.60	$23.00
Reissling	0.57	18.00
Mission	0.11	10.00

Some sixteen years ago I endeavored to call the attention of our vine-growers to the necessity of propagating the more acid varieties of grape; but until within the last three or four years the greater part of our vineyards have been planted with the old Mission grape, undoubtedly the worst wine grape that can be selected.

Regular Meeting, October 18th, 1875.

Second Vice-President in the Chair.

Thirty-five members present.

Donations to the Museum: Three boxes of recent Sea water Shells, from R. H. Stretch. Photographs of relics from mounds, by Mr. Putnam. Mr. S. Jennings, through Dr. Gibbons, presented a pearl taken from a shell found at the Navigator Islands; also the shells. J. F. Jerome presented specimens of the Candle Nut from what the Sandwich Islanders call the "Ku Kui" tree. Black Marble from Alaska, from J. Daniels. Minerals and Fungus, from J. F. Jerome; also specimen of *Holothuria* used as food by the Chinese, shark's fins from China, Orchilla from Lower California. R. H. Sinton presented specimens of Copper ore. C. C. Parry donated specimen of mountain mahogany. Dr. A. Kellogg presented Trout from Inyo County, and seventeen specimens of Lichens. James Behrens presented specimens of radiated pyrites from Prussia.

Mr. C. D. Gibbes described the Candle Nut presented as the fruit of the *Aleurites triloba*, a tree of the family *Euphorbiaceæ*, grows 20 to 30 feet high; leaves tri-lobed; fruit about two inches in diameter; inner nut very hard shell, within which the meat is preserved for years; good to eat, but rather rich. The oil is easily expressed, and is sent to England for candle making. As a drying oil it ranks among the best. The Hawaiians string the kernels of the nuts on slender strips of bamboo and light them as candles; they burn with a peculiar but pleasant odor.

Dr. G. F. Becker read a paper on "Notes on a new feature of the Comstock Lode."

Dr. Hermann Behr made some remarks on "Phylloxera."

Henry Edwards read the following paper:

Pacific Coast Lepidoptera, No. 15.—Description of a new species of Catocala, from San Diego.

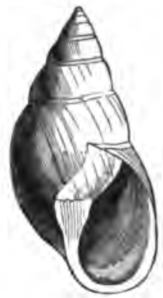
BY HENRY EDWARDS.

Catocala Augusta. n. sp. Hy. Edw.

Primaries. Ground color, very pale fawn-color, almost whitish. All the lines, particularly the sub-terminal, strong and distinct. Basal space, rather large, covered with black irrorations; basal half-line, almost obsolete. T. a., broad on costa, with a double tooth; thence slightly arcuate to a space beyond the middle, there forming a deep tooth, and bent again to the internal margin. This line is deep velvety black, edged anteriorly by a whitish shade. T. p., with a deep median double tooth, running obliquely from the median nerve to the internal margin, in a series of four teeth, and near the margin lost in a brownish shade. Reniform, large, distinct, whitish, edged with black. Sub-reniform, also, large and white, both with grayish shade posteriorly. Sub-terminal line, very strongly marked, with deep but even teeth, edged anteriorly with gray shade. Sub-terminal spots between the nervules, well defined, oblong, deep black. Fringes whitish, mottled with brown.

Secondaries. Rosy red, with yellowish tinge. Mesial band, moderate, almost straight inwardly until it reaches the middle, when it narrows and terminates about 2¼ lines from abdominal margin. Marginal band also moderate, with two rather prominent teeth near the anal angle. Apices, broadly yellow. Emarginations and costa, also, with yellow shade. Fringes, white. Abdominal margin, clothed with fawn-colored hairs.

Underside. The black bands of primaries are very broad; the white ones very clear and distinct; the sub-basal one not reaching the interior margin; and the posterior one much wider on the costa than on the internal margin.



I.

II.

1. Bulimus pallidior, *Sby.*
2. Helix Veatchii, *Newc.*

Loaned by Smithsonian Institution.

VITALITY OF LAND MOLLUSKS. (STEARNS.)

(TO FACE PAGE 188.)

Secondaries, two-thirds pale yellowish red, the mesial band narrower than on the upper side.

Expanse of wings, 3.30 inch.

Locality, San Diego, Cal. Mrs. Jas. Behrens.

The upper wings of this beautiful species recall the shade of the European *C. Fraxini*, but they are still paler in color, and with the lines even more distinctly marked. Its nearest ally is *C. Luciana*, Hy. Edw., from Colorado, but it differs from that species by its paler gray color, by the reniform and sub-reniform being whitish instead of black, by the lines being more deeply and regularly toothed, and by the extreme distinctness of the subterminal line. The color of the secondaries have also a more rosy tint than those of *Luciana*.

For this interesting addition to our insect fauna, we are indebted to Mrs. James Behrens, who has frequently added great rarities to her husband's collection, and to whom, through the medium of her given name, I have great delight in dedicating it. Mrs. Behrens took two specimens of this charming insect in August last, in the neighborhood of San Diego.

Mr. Stearns read the following paper:

On the Vitality of Certain Land Mollusks.

BY ROBT. E. C. STEARNS.

I submit for the inspection of the Academy a living specimen of *Bulimus pallidior*, Sby., one of nine given to me by Prof. Geo. Davidson, who collected them at San José del Cabo, Lower California, in March, 1873.

These snails were kept in a box undisturbed until June 23d, 1875, when I took them out, and, after examination, placed them in a glass jar with some chick-weed and other tender vegetable food, and a small quantity of tepid water, so as to make a warm humid atmosphere. This hospitable treatment induced them to wake up and move about after their long fast and sleep of *two years, two months and sixteen days*. Subsequently all died but this, which seems to be in pretty good health, though not very active.

It may be remembered that I mentioned before the Academy at a meeting in March, 1867, an instance of vitality in a snail (*Helix Veatchii*) from Cerros Island, even more remarkable, the latter having lived without food from 1859, the year when it was collected, to March, 1865, a period of *six years*.

The famous specimen in the British Museum which is cited in the books, *Helix desertorum*, had lived within a few days of four years, fastened to a tablet in one of the cases, when discovered to be alive.

Helix desertorum, as the specific name implies, is found in arid and sterile areas, in the continents of Africa and Asia, and has, as will be perceived, a wide distribution. From the former continent, I have specimens from Egypt, and it also ranges through Arabia in the latter.

The *Bulimus* from the main-land of the peninsula of Lower California, and

Helix Veatchii from Cerros or Cedros Island, off the coast on the ocean side of the same, come from within the same physical environment, being comparatively a limited distance apart.

The *Helix* belongs to an interesting and peculiar group, probably varieties of one species, which includes, at present, the following names: (1) *Helix areolata*, Sby., (2) *H. Veitchii*, Newc., (3) *H. pandoræ*, Fbs., and (4) *H. levis*, Pfr. Other forms geographically approximate may hereafter, on further investigation, be referred to the same lineage.

Of the above, (1) *H. areolata* was the first described, or I should say that this appears by the date to be the first name bestowed upon any member of the group. This species has been quoted from Oregon, and (4) *H. levis*, from the Columbia River, in both cases erroneously. The figures in "Land and Fresh Water Shells of North America,"* p. 177, are too elevated and globose for the typical *areolata*, but the larger figures faithfully represent *H. Veatchii*. Elevation and rotundity are insular characteristics in this group, and *areolata* is comparatively depressed. It is found in considerable numbers on the uplands around Magdalena Bay, which is on the outer or ocean shore of the peninsula, in latitude about 24° 40′ N.

Bulimus pallidior, which is pretty generally distributed through Lower California, from Cape St. Lucas northerly, has also erroneously been credited to San Diego in California proper. It is arboreal in its habits, at least during the winter season, and frequents the Copaiva trees. It has been said to inhabit South America, *which is probably incorrect*, and the locality "San Juan," mentioned in "L. and F. W. Shells," on p. 195, where a good figure of this species may be seen, should be *San Juanico*, which is on the *east* side of the peninsula, in latitude about 27° N.

The great importance of particularity in habitat will be at once perceived when I state that there are no less than *three* other localities on the west coast of America, *north* of the place cited, all of which are referred to in various scientific works which have come under my observation, as "San Juan," and there are perhaps as many more "San Juan's" *south* of that especially quoted herein, on the westerly coast of America, in the Central and South American States.

Attention is directed to the fact that the three species herein mentioned as exhibiting extraordinary vitality, belong to geographical areas, which receive only minimum rainfall, or which are, in simple language, nearly rainless regions.

Within such areas vegetation is exceedingly limited even in favorable seasons, and the presence and growth of the annual plants is, of course, dependent upon the rainfall; this last occurring infrequently makes the food supply of land mollusks and other phytophagous or vegetable-eating animals exceedingly precarious.

It is highly probable that a careful investigation in this direction will lead us to the conclusion that the land mollusks which inhabit arid areas have, through selection, adaptation and evolution, become especially fitted for the

*Smithsonian Misc. Coll., No. 194.

contingencies of their habitat, and possess a greater degree of vitality or ability to live without food than related forms in what may be considered more favorable regions, and through and by reason of their long sleep or hibernation, *more properly estivation*, with its inactivity and consequent immunity from any waste or exhaustion of vital strength, are enabled to maintain their hold upon life when animals more highly organized would inevitably perish; and we are furnished with an illustration, in the instances cited, how nature works compensatively, when we institute a comparison with the opposite condition of activity, and the food required to sustain it.

Mr. Stearns called the attention of the Academy to certain fossil forms of the genus *Scalaria*, belonging to the sub-genus *Opalia*, discovered by Mr. Hemphill near San Diego.

Regular Meeting, November 1st, 1875.

Dr. Stout was called to the Chair in the absence of President and Vice-Presidents.

Twenty-eight members present.

Messrs. Charles W. Banks and G. F. Becker were elected resident members.

Donations to the Museum: From W. E. Burleigh from Island of St. George, Alaska, one full-grown male fur seal, one full-grown female fur seal, one fœtus (nearly full grown) of fur seal, one young sea lion two months old, head of walrus two years old. The fur seal are carefully collected specimens, complete and suitable for preservation.

Mr. Filhol was introduced by the Chairman and made a few remarks.

Dr. Gibbons made some verbal remarks on the difference in the rainstorms here and in the Eastern States.

Dr. Parry read a short paper in relation to botanical subjects in California.

Regular Meeting, November 15th, 1875.

Second Vice-President in the Chair.

Twenty members present.

Louis Nusbaumer was nominated for membership.

Donations to the Museum: A box of minerals containing 45 specimens, from Dr. E. S. Holden, Stockton. Specimen of Colymbres, presented through Dr. Harkness. Two birds from Navigator Islands, presented through Dr. Gibbons. Specimen of *Cebidichthys crista galli?* Ayres, from Captain Lawson, U. S. Coast Survey. Five specimens of fish from the lower waters of Kern River, from J. R. Scupham. Silicified wood from Sonoma County, by G. H. Saunders.

S. C. Hastings read a letter from Professor J. D. Whitney relative to the "Botany of California," to the effect that the work was nearly completed and ready for publication.

J. R. Scupham made some verbal remarks on the Toredo, presenting also a specimen of wood showing a curious instance where one of the rotifers had bored into the hole of its neighbor, the first instance where such an occurrence had been noticed.

A verbal discussion on the subject of Phylloxera was participated in by Dr. Behr, Dr. Blake, Dr. Kellogg and S. C. Hastings.

Regular Meeting, December 6th, 1875.

Second Vice-President in the Chair.

Thirty-five members.

T. W. Greene and Dr. Murphy were proposed for membership.

Donations to the Museum: Twenty-six specimens of Native Woods, presented by Mr. Joseph H. Clarke, Cahto, Mendocino County. Native Fishes, W. N. Lockington. Three specimens

of Fish and nine specimens of Crustaceans from Captain M. Turner. *Pinus aristata*, Dr. A. Kellogg. Acorns and branch of *Quercus fulvescens*, George W. Dunn. Specimen of *Artemia Utahensis*, from Dr. Harkness. Two Crustaceans and thirty-two specimens of *Myriapoda*, from Henry Edwards.

Dr. Kellogg explained that the donation of woods from Mr. Clarke was very valuable, all the specimens being in fine order and carefully prepared. A vote of thanks was passed to Mr. Clarke.

Dr. Harkness exhibited a map presented by General Stone, through Governor Purdy. The map shows the work done by American Engineers in Africa for the Egyptian Government, in the course of a survey.

Mr. W. N. Lockington read a description of the fish presented at the previous meeting.

Mr. Lockington also read a paper on Landscape Gardening, giving a list of the varieties of plants and shrubs adapted to California gardens, and containing suggestions as to the proper laying out of grounds.

Dr. J. G. Cooper presented the following:

New Facts relating to Californian Ornithology—No. 1.

BY J. G. COOPER, M. D.

The publication of the volume on Land Birds in the series of Reports of the Geological Survey of California brought down the history of that class of animals, for the most part, to 1870, although, having been written five years previously, many additional facts had accumulated, which could not be introduced into it, as only stereotyped proof-sheets were sent to me for correction. Some of these facts have been published by me in our Proceedings for 1868, Vol. IV, p. 3, as "Some recent additions to the Fauna of California," and more or less contributed to the "American Naturalist," or the following more recent works. The present remarks are intended to include only such later items as have never been published, or such opinions as differ from those of later authors. The following are the chief works relating to this subject that have appeared since 1865:

Birds of Ft. Whipple, Arizona, or Prodrome of Ornithology of Arizona Territory. By E. Coues, A. M., M. D., U. S. A. From Proc. Phila. Acad. Nat. Sciences, Jan. 1868.

The New and heretofore Unfigured Birds of North America. By D. G. Elliott. New York, 1869. Folio.

List of Birds of Alaska, with biographical notes. By Wm. H. Dall and H. Bannister. From the Proc. Chicago Acad. of Sciences, 1869, 4to. Also Mr. Dall's later articles in our Proceedings, on Alaskan birds.

A History of North American Birds, by S. F. Baird, T. M. Brewer, and R. Ridgway, Land Birds, in 3 vols., small 4to. Boston, 1874.

Birds of Western and Northwestern Mexico, from Collections of Col. A. J. Grayson, Capt. J. Xantus, and F. Bischoff. By G. N. Lawrence. From Memoirs of the Bost. Soc. of Nat. Hist., 1874. 4to.

Birds of the Northwest (the region of the Missouri R.) By E. Coues, M. D., U. S. A. Washington, 1874. 8vo.

Report on Ornithological Specimens collected in the Years 1871, 1872, and 1873, in Nevada, Utah, and Arizona. By Dr. H. C. Yarrow, H. W. Henshaw, and F. Bischoff. Washington, 1874. 8vo.

For convenience of reference, I give the pages of Ornithology of California, Vol. I, where the species are described.

TURDUS NANUS—The Dwarf Thrush, page 4. The notes given by me in the lower five lines of this page belong properly to the next species, as it is scarcely probable that any of this remain in the lower country of California, or even in the mountains in summer, unless above an elevation of 8,000 ft., as does its Rocky Mountain representative, var. *Auduboni* Baird. The song of that, and of the eastern race, var. "*Pallassi*" Cab., being described as resembling that of the Wood Thrush (*T. mustelinus*), with which I am familiar, I am sure that I never heard it in the Sierra Nevada up to 8,000 ft. alt., nor in the forests of Washington Territory, and that of var. *nanus* cannot be very different.*

It is the winter thrush of California, common from September to May.

As pointed out by me in the Amer. Naturalist, Jan. 1875, the name *nanus* has priority over *Pallassi*, but that of *guttatus* Pallas, 1811, will very probably become the specific appellation, being founded on a specimen from Kodiak, where this only is found. The description, however, is as applicable to young of *Myiadestes Townsendii*, and it was called a "*Muscicapa.*" Bonaparte, in Comptes Rendus, 1854, thinks it is "very certainly the *T. Swainsoni*, but *may* not be the *T. Pallassi* of Cabanis." The size. however, does not agree with either of them, and perhaps for this reason Cabanis substituted *Pallassi* (founded on a Cuban specimen) for his *T. guttatus*, 1844, founded on Pallas's bird. The African *T. guttatus* Vigors, need cause no confusion, being doubtless a later named species.†

T. USTULATUS—Oregon Thrush, p. 5. This name is also prior to those of its eastern representatives. Townsend and Audubon confounded it with *T. fuscescens* ("*Wilsoni*"), which opinion was formerly endorsed by J. A. Allen; while Coues in 1872, and later authors, make it a variety of "*T. Swainsoni*" Cab. This, besides being named later, was described as from Siberia,

* The song described by Ridgway as of *T. ustulatus* in the Sierra Nevada, and like that of the Wood Thrush, was more probably that of *T. nanus*.

† *T. Aonalaschkæ* Gmel answers still better to the young of *T. nanus*, and could scarcely be a fringilline bird, as suggested by Baird, for Gmelin described the three spotted sparrows from there as "*Fringilla*," &c. *Melospiza Lincolnii* could scarcely be confounded with it. See farther on, under *Passerculus Sandwichensis*.

and a comparison of types seems needed to establish its identity. As, however, it is reported as straggling to Central Europe (as well as "*Pallasi*") it might much more easily reach Siberia from Alaska, where it appears to go farther north than var. *ustulatus*. The claim of "*T. brunneus*" Boddært, 1783, as being of this species, seems worthy of further examination.

I was misled in giving *T. nanus* as the common Summer Thrush of California, both by its having been given by all previous authors as the only small brown thrush found in the State (*ustulatus* being limited to the north), and by Heermann's positive assertion that it breeds in the oak groves near San Francisco, where I am now satisfied that only *ustulatus* spends the summer. I have since found the latter breeding as far south as lat. 35° at least, and probably to lat. 33°. There they are more olive than at the Columbia, approaching var. "*Swainsoni*," and are also smaller, as might be expected. This southern residence suggests that the Mississippi valley summer thrush of Audubon, and Wilson's Georgia birds, with similar nest and eggs, are the var. "*Swainsoni*," these authors not recognizing its distinctness from var. "*Pallasi*."

Our bird does not reach California from the south before April 15th, and leaves during September, thus supplementing the winter residence of *T. nanus* so fully, that they are easily mistaken for one species, more noisy and conspicuous in summer, their upper plumage being nearly the same in California.*

* The following measurements taken by me from fresh birds now preserved in the Smithsonian Institution, the State Museum of California, and my own collection, show that there is such a gradation in size between specimens of the two species collected in different latitudes, that no difference is noticeable in living birds at gunshot distance. The older specimens are recorded in P. R. Rep. IX, 213, 215, etc.

Species.	Locality.	Date.	Sex.	Length.	Extent.	Wing.	Cat. No.
T. ustulatus	Wash. Terr.	May 31, 1854	† ♂?	8.00	12.25	3.75?	S. I. 8171....
"	" "	" " "	† ♀?	7.25	11.75	" ?	" 8172....
"	Saticoy, Cal ...	Sept. 7, 1873	♂	7.00	12.25	4.15	J. G. C. 1559.
"	" "	May 6, 1874	♂	7.00	11.40	3.75	" " *a*
T. nanus	St. Clara, Cal...	Nov. 18, 1855	‡ ?	7.00	10.50	3.30?	S. I. 4483....
"	" " ...	" " "	‡ ?	6.50	9.25	" ?	" 5943....
"	Ft. Mojave, Cal.	Jan. 25, 1861	♂	6 50	10.50	3.35	J. G. C. 64 ..
"	Saticoy, Cal	Nov. 7, 1873	♀	6.50	10.40	3.35	" " *a*.

† The sex of two is surmised on difference of size. The wings were not measured in these two. The wing of all the S. I. birds is given as above from Baird's average.

‡ The two first were young of the year.

It appears from Mr. Henshaw's measurements, in his report for 1873, that Arizona specimens of *T. nanus* average smaller, and he remarks on the contrast in size between them and var. *Audubonii*, as seen in Colorado, much larger than *T. ustulatus*.

Although the nest and eggs of this variety may have led to its correct affiliation with "*Swainsonii*," they are not always reliable in this genus, if Dr. Coues is right in stating that *T. fuscescens* sometimes lays spotted eggs, and builds either on the ground, in bushes, or in trees! (Birds of the Northwest, 1874). If a few more of the best marked distinctions become broken down by future observations, we may yet find that all the six races now divided into two or three species must be combined in one (a "*T. parvus* Seligmann, 1775"?).

T. Aliciæ? Baird—Alice's Thrush—In a note given by me in the "Nat. Hist. of Wash. Terr.," 1860. Zool. p. 171, I stated that I had seen two thrushes there in December and March, quite unlike *ustulatus*, which I then knew to be a summer visitor only. I compared them to Wilson's plate of "*solitarius*" (var. Swainsoni ?), and Swainson's of "*minor*" (var. Pallassi ?), but neither is at all likely to winter so far north. "Their color was a very dark brown, without a tint of olive, and the breast more thickly marked with spots of the same color, large and round." This agrees so nearly with Baird's description of the winter plumage of *Aliciæ* (then unknown), that they may be considered either to have been Alaskan specimens of that bird (not since seen in the U. S. in winter), or stragglers from Asia of a foreign species.

Harporhynchus redivivus—California Thrasher—p. 16. Eggs laid in a nest at Saticoy, Ventura Co., May 26th, hatched in 13 days. The length given in the text referred to, as 1.10, should be 1.20. The iris, colored yellow in many copies of the Cal. Ornith., is really brown, as in all the Californian species.

Polioptila cœrulea—Blue-Gray Flycatcher—p. 35. Can this be the "*Sylvicola cœrulea*," quoted by Townsend and Audubon from the Columbia River? That species is not now found west of long. 100°, while the above migrates north as far as the southern branches of the Columbia at least.

Lophophanes inornatus—Plain Crested Titmouse—p. 42. A curious relationship to *Chamœa* is shown in the tail-feathers of this species, which, under oblique light, show many dark bars above, as in that bird. The same character has recently been ascertained in *Melospiza*, and is quite apparent in some of var. *Heermanni*: also in species of *Peucœa*.

Salpinctes obsoletus—Rock-Wren—p. 64. The eggs described were so much more reddish than authentic examples from farther south described by others, that they may have belonged to the western House-Wren.

Thryothorus spilurus—Bewick's Wren—p. 69. The nest described was so different from that of *T. Bewickii*, that I was induced to consider the bird a distinct species; but as I find that northward it builds in hollow trees, houses, etc., I must suppose that it merely took some other bird's old nest, for want of such accommodations.

Troglodytes (ædon, var.) Parkmanni—Western House-Wren—p. 71. The references to "*T. Americanus* Aud." as from Oregon, by Audubon, Gambel, and Nuttall, were no doubt based on this variety, which is of about the same size, and was not distinguished until five years years later. Gambel, in re-

naming it *T. sylvestris*, had reference apparently to the name "Wood-Wren," given by Audubon to "*T. Americanus*." The latter author and Nuttall both considered it nearest to *T. hyemalis*, instead of *T. ædon*, from which confusion resulted; and Dr. Heermann, in quoting *T. Americanus* from California, as well as *T. ædon*, seems to have meant the American race of the "European Wren" (*T. Europæus* Cuv.), which is *T. hyemalis*. I have seen the latter recently just north of S. F. Bay, near the sea-level, in Sept., and down to lat. 35° from Nov. to March.

HELMINTHOPHAGA CELATA—Orange-crowned Warbler—p. 83—(var. *lutescens* Ridgw.). The nest and eggs described by Audubon, as quoted by me, must have belonged to some other bird. On May 25th, 1874, I found a nest near Haywood, Alameda Co., built on the ground among dead leaves, on a steep slope in the woods, very similar to that of the eastern variety found by Kennicott, and I shot the female for identification. The three eggs, probably a second brood, are clear white, densely spotted with brownish-red specks; size 0.50 by 0.60 inch. They were partly hatched, and probably a second brood.

. DENDRŒCA AUDUBONII—Audubon's Warbler—p. 88. This species, having the greatest adaptability to different climates and foods, far outnumbers all the others. In winter I have seen them pecking at dough and other food thrown out of doors, besides fruit-skins, and green herbage.

DENDRŒCA CORONATA—Yellow-crowned Warbler—p. 89. A female of this species was killed in Oakland, Cal., in the winter of 1872–3, and I shot a very perfect male at Haywood, April 10th, 1875. As they winter as far north as New York, those of this coast may spend that season chiefly north of the U. S., or in the mountains. The nest and eggs, as quoted from Audubon's description, are considered by Dr. Brewer as belonging to some other bird—(See N. A. Birds, I. 228).

DENDRŒCA TOWNSENDI—Townsend's Warbler—p. 91. I saw one of this species at Haywood as early as Sept. 12th, 1875, in company with several of our summer warblers; so that it is probable that some of the species may breed not very far to the north. I saw no more until Dec. 5th.

GEOTHLYPIS TRICHAS—Yellow-Throat—p. 95. As I suspected, this species winters in great numbers in California, between lats 38° and 35°. I found a nest near Saticoy, Ventura Co., containing young on Apr. 22d, nearly as early as I before recorded them as migrating near San Diego. I have seen none in summer in the windy region around S. F. Bay, though a few winter there.

MYIODIOCTES PUSILLUS—Black-capped Warbler—p. 101—(var. *pileolatus* PALLAS). Although described by Baird in N. A. Birds, I. 319, as having a shorter wing and tail than the eastern var., the measurements and remarks in Pacific R. R. Rep. (Birds IX, p. 293) indicate the contrary, as well as larger size, according to the usual rule in west coast varieties.

As suggested by me, the arrival of this species in California is usually much earlier than observed in 1862, as I found them in 1873 near Saticoy, lat. 35°, on March 18th, the males migrating north in large numbers, and singing

much like *D. æstiva*. I no doubt mistook them for that species at Puget Sound in 1854, reaching there by Apr. 10th, as mentioned in Zoöl. of Wash. Terr., p. 182. I now find that they are a month earlier than that bird in California.

In May, 1875, I found a nest of this species built about four feet from the ground in a thicket of nettles at Haywood, Alameda Co. It was neatly formed of vegetable fibres and grass-leaves, 3½ inches wide, 2½ high, the inside 2½ wide and 1¼ deep. The three eggs measure 0.68 by 0.52 in., a little larger than those described by Dr. Brewer, and are white, with a scattered ring of brown specks near the large end. As this bird breeds so far north, and to the summits of the highest mountains where wooded, its frequency in so warm a locality in summer is surprising; but in 1873 I saw them feeding young at Saticoy, lat. 35°, which is, however, less inland and about as cool. The prevalence of the sea-breeze in summer makes the climate of the coast border within fifteen miles very much like that of the mountain summits at that season.

Vireosylvia gilva—Warbling Vireo—p. 116, (var. *Swainsoni* Baird). This bird seems to arrive much earlier than noticed in former years, as I found them at Haywood, Alameda County, near lat. 38°, by March 31st, 1875, while the date noticed in 1862 at San Diego, was April 10th, and at Santa Cruz, May 9th. Like several other birds, those that go inland appear to come earlier than those traveling along the coast; or, from being more common, their first arrival is more easily observed.

Ampelis garrulus—Arctic Wax Wing—p. 127. The locality of my specimen, although doubted by some recent authors, may be verified by inspection of the original in the University of California, where it has been for a long time comparable with native specimens of *A. cedrorum*.

Pinicola canadensis—Pine Grosbeak—p. 151. A specimen which I shot in August, 1870, near the summit of the Pacific R. R. Pass, over the Sierra Nevada, was of a fine *orange-red* color, but beginning to moult. This plumage, which is not described by Baird, is stated by Nuttall to be the most adult condition of the species, the *carmine-red* characterizing younger birds. It may, however, be a fading change, like the yellow seen in caged birds of some other red species.

Chrysomitris tristis—American Goldfinch—p. 167. The size of the eggs given by me is so much smaller than of Eastern specimens, that Dr. Brewer seems to think it wrong. I have, however, found them at Haywood even smaller, measuring only 0.60 by 0.50 inch, while I did not find either of the other species at Santa Cruz. Mr. W. A. Cooper thinks, however, that *C. Lawrencii* may breed there. At Saticoy I found eggs by April 25th, and at Haywood saw fledged young fed by the male on June 15th, so that they are not always so late in building on this coast as on the eastern. The eggs vary, as elsewhere, from white to pale bluish. This and the two next are called here, "Wild Canaries."

C. PSALTRIA—Arkansas Goldfinch—p. 168. This also, builds plentifully about Haywood, and the nests are not distinguishable, except in smaller size, from those of *C. tristis*, but built much earlier. Some were begun by March 1st, but finished slowly, only being worked upon when the day was warm. One was built in a rose-bush, not over four feet from the ground and close to the path, where we often looked at the female sitting on four eggs, which hatched in 12 days. The eggs here differ so much from those of *C. tristis*, that I doubt whether Dr. Brewer ever saw authentic specimens, they being much more bluish and less pointed in several nests which I compared, though one set was nearly white. I saw the first fledged young being fed by the parents, as early as April 30th. The males often breed in the same dull plumage as the females, and are all much less brightly colored in summer than in winter. Some of them at that season look almost black enough above for var. *Arizonæ*. Their flight is not undulating, like that of *C. tristis*, but with a weak fluttering motion of the wings; nor do they have a flying song, like that species. In March and April, these birds join with most of the other smaller birds in feeding on the caterpillars, which then swarm so thickly on the oaks as to destroy every one of the first growth of leaves. Though a new growth succeeds, there are some trees kept bare the whole summer, or stripped by successive broods of caterpillars.

C. LAWRENCII—Lawrence's Goldfinch—p. 171. I have recently seen this species near San Francisco in winter very rarely, and I did not see any at Santa Cruz or Monterey even in summer. They reach S. F. Bay in large numbers after March 20th, and scatter through the oak-groves in pairs, building early in April, chiefly in low branches of the live-oaks. Recently, some have begun to build in gardens, chiefly in cypress and other evergreen trees, where I found several nests. The eggs I find more elongated than those of *C. psaltria*, being 0.65 by 0.48 inch, and *pure white*. They were hatched in about 12 days, and in 12 more the young left the nest, following the parents with the same cry of "she-veet" as those of *C. tristis*, but as with *C. psaltria*, the flight of adults is without cry or undulations.

C. PINUS—Pine Goldfinch—p. 172. In 1874, I found that this bird is a summer resident in the cool foggy pine woods near Monterey, probably the only point suited for it at that season south of lat. 40° on this coast. I saw them there, building a nest in a high pine, in June. They come about San Francisco and Santa Cruz in small numbers in winter, and I shot one at Haywood as late as April 10th, 1875, where a few were with other species feeding on the caterpillars which then swarmed on the oaks. There are no coniferous forests about this place to attract them. They fly so much like *C. tristis* as to be easily mistaken for them in winter, but the only species that has the peculiar sharp note like "svéer" uttered by this species, is *C. Lawrencii*, which is also much hoarser in its song than the others.

PASSERCULUS SANDWICHENSIS—Alaska Sparrow—p. 180. Although late authors have made this a variety of *P. savanna*, it must claim the typical place by right of priority, while "*Emberiza arctica*" Latham 1790, may prove to be founded on the more eastern "*P. princeps*" Maynard 1874. "*E.*

chrysops" Pallas 1811, is also preferable to *savanna* Wilson, who seems to have given the name by mistake for the doubtful "*E. savanarum*" of Gmelin. If *Sandwichensis* is retained, there can be little doubt as to adopting also Gmelin's "*Turdus Aonalaschkæ*" founded on the "Aonalaska thrush," as this was called the "Sandwich or Aonalaska Bunting." The chances for confusion to have arisen in Gmelin's classification, are more than two to one in this case of the Bunting, above those likely to occur in his naming a bird *Turdus*. (See *T. nanus*).

P. (S. var.) ALAUDINUS—Skylark Sparrow—p. 181. The original type of this variety was from "California" (probably Bodega), and therefore represents the race so near var. *savanna*, which was first identified with it by Prof. Baird, and *not* the more inland, paler and smaller race, which he has so named in his latest work. As, however, all the races are admitted to intergrade together, it is perhaps not improper to give the name to the extreme variety, and to consider the California birds as linking it with var. *anthinus*, which seems to be his latest opinion. The measurements I gave from fresh specimens, as well as the new figures of heads given by him in N. A. Birds, show how uncertain are characters based on size to distinguish even the local races.

P. (S. var.) ANTHINUS—Titlark Sparrow—p. 183. Though Bonaparte's type was said to be from Kodiak I., Alaska, Prof. Baird has only recognized one young bird "of var. *Sandwichensis* approaching var. *anthinus*," from there, and none from the main-land of Alaska, referring all to var. *alaudinus*, including Dall's "*P. savanna*," which merely goes to show that the original type was not a very extreme form.

In 1872-3, in Ventura Co., I again observed the limitation of this variety to the salt marshes while an upland race frequented the dry, grassy hills along the cool sea beach, but not six miles inland, in summer. I found *no nests*, but shot a young bird newly fledged, of the latter variety, in July, which resembled closely the young of var. *savanna* described by Baird in his last work.

P. ROSTRATUS—Long-billed Sparrow—p. 184. The approach of this species to the genus *Ammodromus*, recognized by Cassin and confirmed by its habits, shows that *Passerculus* (as well as *Coturniculus* and *Centronyx*) is scarcely more than a division of that genus, though "*A. Samuelis*," p. 191, is now admitted to be a *Melospiza*. *P. rostratus* represents *A. maritimus* on this coast, while *P. anthinus* is the analogue of *A. caudacutus*. The young is thickly spotted on the breast like that of *A. maritimus*, and like the more southern variety *guttatus*. On May 26th, 1862, I found a nest among sand-hills close to the beach at San Pedro, built like that of *P. savanna*, and containing two eggs, whitish, thickly speckled nearly all over with brown. Though I did not see the bird, there was no other in the vicinity that was likely to have owned them except this species. Mr. Dunn has since found a nest at San Diego, two feet up in *Salicornia*, and with three such eggs, measuring 0.80 by 0.60.

CHONDESTES GRAMMACA—Lark Finch—p. 193. A few of this species winter

near San Francisco, where I saw them in the middle of January, 1875. The occurrence of this species farther east than formerly, some even to the Atlantic coast, seems to show that the denudation of the greater part of the Appalachian forests, is producing the effect of making that country so much better suited to the habits of birds of the great western plains, that they are gradually moving eastward. This migration, commenced by the Cliff Swallow in 1811, is now noticed in the Yellow-headed and Brewer's Blackbirds, the Magpie, Arkansas Flycatcher, and several others more fond of the forests, most of which could not have been overlooked by the old observers.

GUIRACA CŒRULEA—Blue Grosbeak—p. 230. In 1873, I saw the males of this species migrating north in small parties through Ventura Co. on April 17th, so that they come earlier along the coast than at Ft. Mojave. On the same day the allied *Cyanospiza* was migrating, as usual, in flocks, together with *Dendrœca æstiva*. In 1875, the two latter reached Haywood, Alameda Co., April 20th; but the Grosbeak seeks a more inland route toward the north. The arrival of most spring birds is varied a week or two by the winds and weather, as a few warm days and south wind always bring them in large flocks, when the contrary conditions either delay them all, or make them arrive in scattered order. The prevalence of fogs for 20 miles inland during many nights of spring also changes the route of some or all the migrants.

AGELÆUS TRICOLOR—Red and White-shouldered Blackbird—p. 265. The eggs of this bird, instead of being like those of Brewer's Blackbird, as I quoted from Dr. Heermann, are almost undistinguishable from those of the other Redwings. Dr. Brewer calls them deeper blue; but many found by me at Saticoy, Ventura Co., are rather pale green, with few dark brown blotches and lines near the large end. The nest differs more, being of straws, stems, and leaves, twisted around several upright stems of nettles, about four feet from the ground, and in the forks of the plants. They are about 7 inches high, 5 wide, inside 3 by 3, with a fine grass lining. Hundreds built in one nettle thicket, around a marshy spot, but none in the cat-tails or rushes near by. The nettles were a protection from raccoons, etc.

CORVUS (AMERICANUS var.) CAURINUS—Western Crow—p. 285. Prof. Baird still insists on the specific distinctness of this form, as found from the Columbia River to Sitka, returning all Californian specimens to *C. Americanus*. The differences now first given by him are, "tarsus shorter than the bill, 1st quill longer than 10th, gloss deeper," besides the smaller size. But the plates in his former work, and the tables given with them, do not show such a constant difference in bill and tarsus as "culmen, 1.95; tarsus, 1.70," nor do they show any marked disproportion in the wings or tarsi of the two "species." The var. *Floridanus* is quite as peculiar in having larger bill and tarsus, but many intermediate specimens, some of which I myself collected at Ft. Dallas, Fla., connect it with *Americanus*.

In the same way the California birds connect the var. *caurinus* with *Americanus*. In his former work, Prof. Baird himself mentions the less graduated tail of Californian skins, and includes in *caurinus* several northern specimens of intermediate sizes.

Finally, the eggs show a regular gradation between the smallest northwestern and largest Floridan. The most peculiar habit of northwestern birds is that mentioned by J. K. Lord, in the close resemblance of their nests to those of the magpie. But as they do not build such nests near the mouth of the Columbia where no magpies are found, I have no doubt that those he saw thus used had been stolen from the magpies by the stronger crows.

PICA? (PICA var.) NUTTALLI—Yellow-billed Magpie—p. 295. This variety or race of the circumboreal *Coracias Pica* Linn. 1735, is not common near Monterey, as was stated on authority of Dr. Canfield, as I saw only two or three pairs within six miles, and a native of the place told me he had not seen so many before in thirty years. They are, however, great wanderers, like the other races, and may reside a few years at a place which they afterwards desert for a longer or shorter period. I have been told that they were formerly numerous in places where none are now found, and in 1855 I found them common twenty miles nearer San Francisco, to the south, than they were in 1873, when I saw none nearer that city than sixty miles in any direction.

One reason may be the reckless scattering of poisoned grain by the farmers to destroy squirrels, which has also destroyed the quails and numerous small birds, besides driving off or killing the crows and jays. But, on the other hand, in 1860 I found the var. *hudsonica* numerous at Ft. Vancouver, Columbia River, where I saw none in 1853-4, but where Townsend and Nuttall saw a few also in 1834. The high cold winds are sufficient cause for their permanent absence from near S. F. Bay, where several other birds are equally absent for the same reason, especially those of non-migratory habits.

CYANURA STELLERI—Steller's Jay—p. 298—(var. *frontalis* Ridgw. 1874). I found a few of these birds breeding in the dense pine woods at Monterey in 1874, and shot a young bird of the year in July, 1875, about 25 miles east of San Francisco, which had probably been raised in the redwoods at least 12 miles distant.

CONTOPUS BOREALIS—Olive-sided Flycatcher—p. 323. The statement by myself that this bird is "resident" north of Monterey is not confirmed by late observations, though I have never seen any migrating through the southern part of California, which ought to be as well suited for them in winter as Texas. If they fly from one pine-clad range to another when migrating, without stopping on the way, their journeys must be long and far to the eastward.

CONTOPUS RICHARDSONII—Short-legged Flycatcher—p. 325. Although most late authors rank this as a western race of *C. virens*, they do not mention intermediate specimens, and the differences, from their own accounts, appear quite marked. This has the wings longer and more pointed, feet larger and stouter, darker back, no light space on breast, more forked tail, and different notes and habits. Both breed in Texas and both winter in Central America, apparently without mixing. The two species are as different as *C. borealis* and *C. pertinax*. The western bird, though ranging to Wisconsin, can scarcely be supposed to reach Labrador habitually, and it now appears that Audubon's description of the nest and eggs found there was entirely incorrect, answering better to that of some warbler.

EMPIDONAX (PUSILLUS var.) TRAILLII—Traill's Flycatcher—p. 327. I have no doubt that the Colorado valley specimens mentioned were of this race, though the differences between it and var. *pusillus* are now narrowed down by intermediate specimens to a more brownish-olive color, and darker wing-bands, shorter tail and tarsus. I have since found other specimens connecting them not uncommon in Ventura Co., where I saw none until May 22d, when their peculiar notes became noticeable. These differ from any I have ever heard uttered by the true *pusillus*, which is an abundant species in the north, and was only by accident omitted in my published report on Cal. Ornithology. The whole description of its nest, eggs and habits was by a blunder inserted under *E. Hammondii* on p. 331, from line 9 to 28, which species was reported by Baird, from Monterey.

E. (FLAVIVENTRIS var.?) DIFFICILIS.—Yellow-bellied Flycatcher—p. 328. The western race of this species proves to be really more different from the eastern than that of the preceding, and especially in laying spotted eggs, which, indeed, scarcely differ from those of *E. pusillus*. If the allied *Sayornis* (and some other birds) did not show a similar, though less marked, variation in its eggs, independent of regional variations in plumage, we might decide from this the question of identity, but there seem in this case, also to be intermediate birds. At Haywood, Alameda Co., I found about twelve nests and captured enough birds on them for certainty. All were built in the hollows outside or inside of stumps and trees from two to ten feet above ground, or against the walls of little caves in rocky banks, and two on timbers under sheds. Mud is used for the shell, covered outside with much green moss and lined with fine grass, fibres, etc., thus being quite different from that of the eastern bird as described.

The eggs varied a good deal in size and form, usually being larger than those of *pusillus* from Santa Cruz, length 0.73 to 0.62 by 0.58 to 0.52. Even when under sheds the green moss was liberally used, making the nests even more conspicuous than without it. This was the only species I found breeding near Haywood, and it arrived there March 31st, though I found them near Santa Barbara by the 21st, in 1873, three weeks earlier than noticed at San Diego. The differences in the two races seem to be wholly in shades of color and size, not in proportions, as formerly supposed, when young autumn specimens of var. *difficilis* were the types described.

CHÆTURA VAUXI—Oregon Swift—p. 357. Arrived or passed through Ventura County, northward, on April 22d, 1873, and through San Diego on April 26th, 1872. As this is now considered the western race of *C. pelagica*, and winters on the west slope of Central America, the undecided question as to where the eastern birds winter, suggests that they may either be the "var. *poliura*," of South America, or the species mentioned by Nuttall, as follows: "The wonderful account of the swallow-roosts in Honduras given by Capt. Henderson, appears to be entirely applicable to this species." (Man. I, 738.) The *C. zonaris* or some other species may, however, be referred to. I cannot consider this bird a western race only of *C. pelagica*, as intermediate forms are still unknown.

Calypte anna—Anna Hummer—p. 358. This species though mentioned by Gould as Mexican, had not been detected in the intermediate territory of Arizona until 1874, when Mr. Henshaw obtained them there. Very few of the California birds, however, leave the State in winter, if any.

I have found eggs vary from 0.60 to 0.52 long, by 0.40 to 0.35, and the nests vary half an inch in depth, according to the degree of exposure to the wind of their locations. The amount of moss put on the outside also varies, from almost none to a complete covering, as no doubt is the case with those of other species. They lay eggs as early as Feb. 1st, in lat. 38°!

Stellula calliope—Calliope Hummer—p. 363. A male of this species was shot at Haywood, Alameda Co., April 17, 1875, the first yet found west of the Sierra Nevada, and no doubt a straggler.

Geococcyx Californianus—Road-Runner—p. 368. At Saticoy, Ventura Co., I found a nest of this species built in a small Chilian pepper-tree (*Schinus molle*), growing in a hedge, containing two eggs, apparently deserted, on April 12th, 1873. It was only four feet above ground, and not much hidden, built of coarse sticks, with lining of straw and dry horse-dung. From seeing only Barn Owls about there, I supposed it to belong to that bird, the eggs agreeing more nearly with theirs in form than with the one I described, which was laid in a cage. From Dr. Brewer's account of the usual size and form of their eggs, I am, however, now satisfied that they belonged to this bird. The largest measured 1.55 by 1.20 inch. In the appendix to Dr. Brewer's work this nest is mentioned as a Barn Owl's.

Picus (pubescens var.) Gairdneri—Gairdner's Woodpecker—p. 377. This race of *P. pubescens* was in 1870 supposed to be absent from Southern California; but in 1872–3 I found it a common species in Ventura Co., lat. 35°, in the cool groves near the mouth of Santa Clara River, where it took the place of *S. Nuttalli*, a species more common in the warmer valleys farther inland. The specimens obtained are much nearer like the eastern race than those from the north.

I must here remark that, from the too liberal use of the names of favorite saints by the Spaniards, it is necessary to explain that the river above mentioned is over 150 miles south of the "Santa Clara Valley" near San Francisco Bay, mentioned as the southern limit of this species (and elsewhere in Orn. of Cal., Vol. I), which is more often called San José Valley.

Colaptes auratus—Golden-winged Flicker—pp. 410, 412. It is very remarkable that specimens differing from the eastern bird only in the black cheek-patches being tipped with red (which is reported also of Florida and New Jersey specimens), should occur close to the Pacific coast, where we would expect the characters of *Mexicanus* to predominate even in hybrids. On Nov. 21st, 1872, I shot a splendid male specimen near San Buenaventura, which can scarcely be supposed to have straggled from Alaska so far south, and, like those found near S. F. Bay, indicates some yet unexplained law of distribution. It was considerably smaller than those of *Mexicanus* shot in the same region, and probably not migratory.

The following shows the comparative sizes of these and of *C. chrysoides*, from Ft. Mojave, in same latitude:

C. AURATUS ♂; length 13 inches, extent 20.20, wing 6.35.

C. MEXICANUS ♂; length 13.75 inches, extent 21.40, wing 6.75.

C. CHRYSOIDES, ♂; length 11.75 inches, extent 19.25, wing 6.25.

The colors of iris, bill, and feet were alike, except in the last, which had the iris blood-red. It becomes again a question which of the yellow-winged species was Dr. Heermann's "*C. Ayresii*," from Cosumnes River, Cal.

In January, 1873, I shot a specimen of *C. Mexicanus* at the same locality, which attracted my attention by its pale orange-color under the wings. I found it not a hybrid, nor in any way intermediate, but a faded variety, such as is noticed in specimens of other woodpeckers from the hot, arid regions east of the Sierra Nevada. Though its plumage was fresh and not worn, its back was nearly white, with dusky bars, quills gray near ends, and other upper parts pale brown, marked as usual. It was evidently a migrant from the border of the deserts eastward, and showed that climate can have little to do with the characters of the two leading forms, or the intermediate race; which is further proved by the occurrence of two species in the Colorado valley, where no hybrids have so far been found.

The occurrence of *C. auratus* in Greenland and England makes its occasional straggling to California less remarkable; but is it not capable of naturalization here?

STRIX (FLAMMEA var.?) PRATINCOLA—Barn Owl—p. 415. Audubon's account of the nesting of this bird in the grass, though almost incredible, is not much less so than its building *underground*, as it occasionally does in California, selecting a cavity in a steep bank of earth along some stream, where the winter rains leave many such holes, perfectly dry for six or eight months of summer. I obtained five eggs from such a cavity, Apr. 10th, 1875, at Haywood, Alameda Co., where I also knew of nests in hollow trees, among branches, and in a wind-mill, whose owner wisely protected them. Bonaparte's specific name, implying a general residence in fields, was therefore badly chosen for this variety, for which the name *Americana* Aud., 1834, is also prior, and not mistakable for Gmelin's uncertain species. As this owl scarcely goes north beyond lat. 42°, and stragglers are not reported from the interval of over 3,000 miles between its range and that of *S. flammea*, an intermingling of the races must have occurred at a very remote period, if ever. In California it is resident in the northern half of the State all the year, and in winter its numbers are increased by migrants from the north, probably from as far as Oregon, where it was found by Townsend and Peale.

It would not be strange if this owl was found to enlarge its underground domicile when too small by a little burrowing, like the similar-footed but weaker Ground Owl, or as reported of the short-footed *Brachyotus* by Dall.

BUTEO SWAINSONII—White-throated Buzzard (of Nuttall)—p. 476. I shot the first specimen of the typical race recorded from California, on Oct. 2d, 1872, at Saticoy, Ventura Co. Nearly, if not quite all, breeding west of the

Sierra Nevada, are of the var. *insignatus*, while the pale race seems chiefly to prevail in the open and arid regions eastward. I found the dark race breeding down to San Diego, and they seem more common on this slope than the *B. borealis*, even to Alaska. They migrate in flocks, of which one was mentioned in the Orn. of Cal., going north in San Diego Co., April 18th, 1862, and on Apr. 16th, 1873, I saw a similar flock, entirely of *insignatus*, going north over Ventura Co. With the first were some of *Archibuteo* and other species. They returned south about Oct. 1, in Ventura Co., more or less in flocks, while no southward movement of *B. borealis* occurred until a month later. My statement that the average size of this species is equal to that of *borealis* was founded on a comparison of females of this with males of the latter. The wings are longer in proportion, which in dried skins is liable to mislead. The difference between wing and total length I found in six specimens to average only 3.72 inches, while in seven of var. *calurus* it averaged six inches. Although Dr. Brewer thinks that the nest and eggs described by Heermann as of *Archibuteo* belonged to this bird, the description of both seems to me more suited to the latter, which certainly breeds here.

Buteo (lineatus var.) elegans—Elegant Buzzard—p. 477. The description of the young which I copied from Cassin's, is wrong in giving 12 instead of 6 bars on the tail, no doubt inadvertently, as he figures it correctly in Birds of N. A. (P. R. R. Rep. X, pl. II and III). I saw a dead bird of this species in Marin Co., north of S. F. Bay in 1873, and it is doubtless the "*F. hyemalis*" of Townsend's Oregon list, as the eastern race goes north to Nova Scotia. In 1872–3, I found them constant residents of Ventura Co., and not more common in winter.

Buteo oxypterus—Sharp-winged Buzzard—p. 480. A specimen in Woodward's Museum, shot at San Diego in 1871, agrees perfectly with Cassin's plate, and I do not agree with Ridgway in considering it merely a variety of *B. Swainsoni*. Besides its smaller size, it appears to have more transverse scales on tarsus, and its wing is different, both in proportions of quills and length. The dark var. *fuliginosus* is also said to differ from *insignatus* in sooty tint, no white on forehead, under-wing coverts banded white, tail cinereous umber, with seven (not ten) bars. Other differences are noted in the Central and South American specimens, described by Ridgway. Of its relation to *B. Pennsylvanicus*, suggested by J. A. Allen, I cannot decide.

Elanus leucurus—Black-shouldered Hawk—p. 488. Mr. Ridgway's belief that the Australian birds are specifically identical, will make this the *E. axillaris* Latham (1801), var. *leucurus*, but any inter-migration of specimens between the two continents since the pliocene epoch, is more difficult to suppose than in the case of the stronger-winged Barn Owl. Our bird does not seem to go north of lat. 39°, and none are recorded from western Asia. I have seen but one or two in Ventura Co., and none south of lat. 35°, so that the California birds seem to be constant residents in the middle region of the State, where only their favorite marshes are extensive.

Ortyx Douglassii—Vigors, 1829. This is, apparently, merely a newly fledged young California Quail. The locality given, "Monterey, Cal.," goes to confirm this view, and I have found the first plumage agree closely.

J. P. Dameron stated that he had been experimenting on the propagation of Oysters and would shortly describe a method discovered by himself.

Mr. Scupham read a paper suggesting that steps be taken by the Academy to assist in bringing about the resumption of the Geological Survey.

On motion of Mr. Scupham, a Committee was appointed to examine into the matter and report at the next meeting. Messrs. Scupham, Blake and Ashburner, were appointed as such Committee.

Mr. Stearns made the following remarks on the death of Hon. B. P. Avery:

Mr. President and Members of the Academy:

Since our last meeting the telegraph has brought us sad news —information of the death of our fellow-member, the Hon. Benjamin Parke Avery, United States Minister to China, who died in the early part of November at the city of Peking.

The many excellences of the deceased, the co-operative spirit which he ever manifested in all matters pertaining to the welfare of his fellow-men—quietly, because he was singularly modest and undemonstrative, yet nevertheless persistently pursuing the even tenor of what he considered his duty—and that duty the advancement of civilization in a new State, the promotion of knowledge, whether in Literature, Science, or Art—and the general refinement and elevation of the commonwealth in which he had made his home; such qualities and such services make it eminently proper that we should inscribe on the permanent records of the Academy an appreciative recognition of his life and labors, as well as an appropriate expression of our esteem, and of sorrow for his loss.

With the example of his unassuming but honorable career before us—too brief but yet well filled with useful work—it would be in discord with its harmony to expand these remarks into formal eulogy.

In a letter dated July 5th of this year, the last which I received, he wrote:

"Shut within the walls of our Legation, we are as much alone as if we were in one of the old glacial wombs of the Sierra Nevada—to think of which makes me sigh with longing, for was I not born anew therefrom, a recuperated child of Nature? Your letter with bay-leaves was right welcome, and gave me a good sniff of Berkeley. It was pleasant to receive the University bay, although I am not an Alumnus, and can boast no Alma-Mater except the rough school of self-education."

The closing line above his autograph is "O, California, that's the land for me!" Enclosed with his letter were a few plants collected by him upon the broad summit of the mouldering walls which surround the ancient city where he died. Our friend has gone! He has found the tranquillity of the grave in a country remote from his native land—from the California he loved so much; far from those he loved and the many who knew and loved him, and who would have deemed it a privilege to have been near him at the final moment, and to have mingled their last farewells with his. The particulars of the closing scene have not yet been received. We may be sure, however, that he looked into the future without fear, and faded serenely, as the twilight sinks into night.

Those who knew him best, and who enjoyed the precious freedom of intimacy, will tell you that his life was conspicuous for its purity—his character for its many virtues—his intellect for its refined and delicate culture—his heart for its tender and generous sympathy. The possession of these qualities endear a man to his fellow-men; they constitute a charming whole whose priceless web is woven from the choicest graces of our poor humanity; they form an enchanted mantle whose shining folds hide the poverty of human limitations.

So lived and walked our friend among us, crowned with the affection and respect of all who knew him. I do not say that he was perfect, and yet if fault he had I know it not, nor never heard it named.

Here let us rest—grateful that so true a life has been a part of ours. We place our tribute on his grave, and say good friend —farewell!

Resolved, That the California Academy of Sciences has learned with profound regret of the death of the Honorable Benjamin Parke Avery, a fellow-member and late United States Minister at the Court of Peking; that we

hereby recognize and express our high appreciation of his many private virtues and public services.

Resolved, That these resolutions be spread on the records of the Academy and published in the proceedings.

REGULAR MEETING, DECEMBER 20TH, 1876.

Vice-President Edwards in the Chair.

Thirty-five members present.

Donations to the Museum were as follows: Thirty-three specimens of Scorpions from Arizona, from Dr. R. K. Nuttall; also from same donor, one crustacean and one sceloporus. F. Gruber presented a fine specimen of *Cervus Mexicanus*, mounted; *Rhaphidophora subterranea* from Mammoth Cave, Kentucky.

The Nominating Committee appointed by the Council and Trustees presented their report, nominating officers for 1876, as follows:

PRESIDENT.

GEORGE DAVIDSON.

FIRST VICE-PRESIDENT.
HENRY EDWARDS.

SECOND VICE-PRESIDENT.
H. W. HARKNESS.

CORRESPONDING SECRETARY.
THEO. A. BLAKE.

RECORDING SECRETARY.
CHAS. G. YALE.

TREASURER.
ED. F. HALL, JR.

LIBRARIAN.
WM. J. FISHER.

DIRECTOR OF MUSEUM.
W. G. W. HARFORD.

TRUSTEES.

D. D. COLTON,
GEORGE DAVIDSON,
THOS. P. MADDEN,
R. E. C. STEARNS,
WM. ASHBURNER,
GEO. E. GRAY,
R. C. HARRISON.

Charles Wolcott Brooks, of the Nominating Committee, read a statement giving their reasons for having nominated certain of those upon the ticket presented.

On motion, the report of the Committee was adopted and the Committee discharged.

Mr. Scupham, of the Committee appointed on the question of the continuance of the State Geological Survey, reported a Memorial to be transmitted to the State Legislature, asking them to revive the Survey. The Memorial was as follows:

MEMORIAL.

To the Honorable, the Senate and Assembly of the State of California:

The California Academy of Sciences would respectfully represent that the Geological Survey is a work of great practical importance, as well as scientific and educational value, to the people of this State.

That by the action of the Legislature of 1873–74, the accumulated and unpublished material of several years' work was placed for safe keeping in the custody of the Regents of the University, where, for want of further provision, the greater portion still lies unimproved.

That there have been already published four volumes of the geological reports, viz.: one of geology, two of paleontology, and one of ornithology, besides smaller pamphlets, and several topographical maps, the beauty, accuracy and value of which are appreciated and acknowledged by all who have carefully examined them.

That of the unpublished matter already accumulated, there is the material for a second volume of geology, for a volume of botany, nearly ready to be issued, and the greater portion of the material for a second volume of ornithology devoted to the aquatic birds.

That the map of Central California is so nearly finished that the active field work of one more season would complete it. This map embraces nearly one-half the area of the State, and extending from Lassen's Peak on the north, to Visalia on the south; includes all the more important mining districts within the limits of California. The work so far done upon it is unexceptionable, and when completed, it will possess the highest practical value, will meet with a ready sale, and be the most important contribution to the geography of this coast that has ever been made.

That a general geological map of the whole State has been partially drawn and colored, and could be finished and published in such a way as to show the extent of the present knowledge of the geology of the State (subject, of course, to such improvements in detail as may hereafter be developed by future work) at no great expense.

That the U. S. Coast Survey map of the peninsula of San Francisco has been geologically colored in great detail, and only waits the means for its publication.

Finally, that these unpublished works are greatly needed for the benefit of our public schools, as well as for all the higher educational interests of the State, and that when completed, they would convey the most accurate information with regard to our coal fields, quicksilver mines, quartz veins and hydraulic washings, which cannot fail to exercise a most beneficial influence in aiding the further development of these important industries.

In view of the foregoing facts, the California Academy of Sciences would respectfully pray that your Honorable Bodies revive the State Geological Survey, and make a liberal appropriation for its continuance and completion.

On motion, the Memorial was approved and ordered forwarded.

Charles Wolcott Brooks presented an additional or supplementary report from the Nominating Committee, substituting as one of the Trustees, Dr. Geo. Hewston in place of George Davidson, and stating that it had been considered questionable whether the President of the Academy could also serve as a Trustee.

Considerable discussion ensued upon the subject, and finally John F. Miller was elected as a substitute for Professor Davidson.

The following were elected Judges and Inspectors of Election: C. D. Gibbes and T. J. Lowry, Judges; R. S. Floyd and Samuel Hubbard, Inspectors.

[The following paper, read at the Regular Meeting held July 19, 1875, should have been printed in the Proceedings of that Meeting.]

Pacific Coast Lepidoptera, No. 14.—Notes on the Genus Catocala, with Descriptions of new Species.

BY HENRY EDWARDS.

The beautiful moths included in the genus *Catocala* are among the more interesting of the larger *Noctuidæ*, and appear to have obtained their fullest representation on the North American continent. They are natives, for the most part of the northern temperate zone, and though some are said to exist in the Hawaiian Islands, and I am acquainted with one very large species, (a mutilated example of which was collected by the late Baron Terloo, and presented to me by Dr. H. Behr) which comes from the table land of Mexico, near Guadalajara, still the United States, Japan, N. China, Siberia and Eu-

rope must be regarded as the home of the genus, the number of species in our own country far exceeding that of the whole of the other districts put together. According to Staudinger's last catalogue, thirty-four species are found in Europe and the adjacent territories, including Siberia, four or five are known to exist in Japan, and probably the same number in northern China, while the list of North American forms, including those mentioned in the present paper, has increased to no less than eighty-three species. In the islands of the southern Pacific and Australia are several genera which recall the coloration and structure of *Catocala*, but are separated from it by well defined limits, and it is almost certain that no true example of the genus is to be found in the southern hemisphere. Our northern States species have been recently admirably figured by Mr. H. Strecker, in his Lepidopt. Rhopaloc. et Heterocera, while Mr. A. R. Grote, of Buffalo, has published, in the Trans. Am. Ent. Soc., Vol. 4, 1872, descriptions of the whole of those then known to him. In Mr. Grote's valuable paper he has tabulated the genus as follows:

Section 1. Secondaries black and unbanded above.
" 2. " black above, with white median band.
" 3. " various shades of red, with black median band.
" 4. " orange above, with black median band.
" 5. " black above, with narrow yellow median band.
" 6. " yellow above, with median black band.
" 7. " yellow above, without median band.

It is somewhat remarkable that, with one exception, the whole of the Pacific Coast species at present known belong to the third section, viz., those which have the lower wings of various shades of red, sections one, six and seven being entirely unrepresented. The late Baron Terloo is said by Dr. Behr to have observed at San Jose, in this State, a specimen near to *Catocala relicta* (section 2) of New England, and I myself, last year, observed in San Mateo County a very large species, with pale yellow median band, evidently nearly allied to *Catocala cerogama* (section 6). It was sitting on the trunk of a large tree of *Œsculus californicus*, but to my great regret, evaded my attempt to capture it. I could not, however, be mistaken in the color of the under wings. It is quite probable that among our oak groves many species unknown to science exist, and we may confidently hope that those of our coast now enumerated will be at least doubled in the course of a few years. It may be well to notice that these insects come readily to sugar, Mr. G. Mathew, of H. M. S. *Repulse*, being so fortunate as to capture no less than 27 specimens of *C. Aholibah*, Streck., in a single night, on some oak trees prepared by him at Esquimalt, Vancouver Island.

The following are the species at present known to inhabit the Pacific Coast:

Section 3.

Catocala californica. W. H. Edwards, Proc. Ent. Soc. Phil., Vol. 2, 1864.

"Expands $2\frac{3}{10}$ inches.

"Primaries, dark brown, with a gray tinge, the transverse lines rather indistinct, the elbowed line with two teeth, equally prominent, and otherwise

resembling *C. Marmorata*, Edw. Beyond this is a brown band, bordered by a faint serrated, grayish line, which is edged without by black. Reniform, black; sub-reniform, brown.

"Secondaries, rosy red, nearly the same shade as in *Marmorata*. Median band, narrow, almost straight, contracting in the middle, and terminating abruptly two lines before the margin. Border somewhat sinuous towards the anal angle. Apical spot, white, tinged with reddish. Fringe long and white. On the under side of secondaries, the red shade occupies two-thirds of the wing. From Yreka, Cal."—W. H. Edwards, loc. cit.

I have two undoubted examples of this species, both, however in bad condition. one of which was taken near Prescott, Arizona, and the other at Carson City, Nevada.

Catocala Cleopatra. Hy. Edw. n. sp.

Primaries, dark bluish gray, powdered with brown atoms, transverse lines rather indistinct, slightly olivaceous; the t. a. edged with black exteriorly, and with the indentations rather small; t. p., delicately shaded with brown and olive, with two teeth on third and fourth nervures, strongly marked with black. Reniform, indistinct, olivaceous; sub-reniform, whitish, somewhat angular, its longest angle pointing outwardly; above it, and interior to the reniform, is a dull whitish patch; and above the reniform, and touching the costa, is a strongly marked brownish shade. Submarginal line, gray, whitish and broadest towards the apex. Fringes, white, with brownish scales, except where crossed by the nervures where they are black.

Secondaries, bright rosy red, with fawn-colored hairs at the base. Median band moderate; broadest in the middle, not toothed interiorly, and terminating two-tenths of an inch from the inner margin. Marginal band, not broad, except at the anterior angle, slightly sinuous as it approaches the inner margin. Fringes, broadly white, flecked with brown scales. Those of interior margin, long, dark drab, paler towards the base.

Under side. Primaries, white, with the usual black bands, the basal one oblique, shading into the median a little below the middle. Median, moderate, narrowest towards the posterior margin. Marginal band, broad towards apex, shading into fawn color at extreme margins.

Secondaries. Two-thirds of the interior portion, rosy red, as in the upper side, shading into white towards the anterior margin. Fringes, white, a little yellowish at anterior angle. Head and thorax dark gray, mottled with brown and olive scales, whitish on the disc, where the scales form an almost triangular white mark, edged posteriorly with a black line. Abdomen smoky brown above, paler beneath, and there dotted with fine brown scales.

Expanse of wings, 2 60 inch.

Length of body, 1.00 inch.

Berkeley, Contra Costa County, Cal. (One ♂. Coll. Hy. Edw.)

This species may be easily recognized by the bluish gray tint of the primaries, dashed with olivaceous, while the almost regular median band of secondaries, recalls the European *C. Pacta*, and the Atlantic and Canadian *C. Concumbens*, Walk. Like all our Californian species, it appears at present to be exceedingly rare.

Catocala Mariana. Hy. Edw. n. sp.

Primaries, dark iron gray, with bluish tinge, especially towards the margins. T. a., only slightly dentate, shading into black on the costa, and terminating on the interior margin in a whitish patch. T. p., commencing at about one-third the length of costa, then running outwardly into two strong indentations, marked interiorly with black, and towards the interior margin, sinuate into a long and narrow tooth, terminating in white patch on the interior margin. Sub-terminal, whitish. Posterior margins, paler gray, with a row of well defined black dots in the intro-nerval spaces. Reniform, blackish and indistinct. Sub-reniform, open, resting on whitish space. Fringes dull white, mottled with brownish.

Secondaries, rose color, with basal hairs and fringe of anal margin brownish. Median band, moderate, constricted in the middle, forming rather a sharp angle outwardly near its center, which is its widest part. It does not narrow into a point at its termination, but ends abruptly about three-sixteenths of an inch from the abdominal margin. Marginal band, with deeper sinuations, but otherwise resembling the previous species. Fringes, clear white, very slightly mottled with brownish. Head and thorax, iron gray. Abdomen, smoky brown, paler beneath.

Under side, as in *C. Cleopatra*.

Expanse of wings, 2.50 inch.

Length of body, 1.00 inch.

Vancouver Island. Hy. Edw. and G. Mathew.

Closely resembling *C. Cleopatra*, and the Atlantic *C. Briseis*, but differing from the former by the darker color of the primaries, the duller and more scarlet red of secondaries, and by the less regular median band; and from *Briseis* by the broader band of secondaries, and by its abrupt termination far from the abdominal margin.

Catocala Faustina. Strecker. Lepid. Rh. et Heter., No. 3, Page 21.

"Male. Expands 2⅝ inch.

"Body above, gray; beneath, white.

"Upper surface. Primaries, bluish gray, powdered with brown atoms; marginal spots, transverse lines and bands, well defined. Reniform, distinct and surrounded by an outer circle, which is produced in two points on exterior. Sub-reniform, white; above this, and interior to the reniform, is a white space. Fringe, light gray.

"Secondaries, scarlet. Median band, moderately wide, angulated at center outwardly, and terminating somewhat abruptly about two lines from the abdominal margin. Marginal band, with a deep indentation between the first and second median nervules. Apical spot and emarginations, rosy. Fringe, on exterior margin, white; on interior margin, gray.

"Under surface. Primaries, white.

"Secondaries. Interior two-thirds rosy; towards costa, this color becomes lost in white; almost imperceptible indications of a discal lune."—STRECKER, loc. cit.

Arizona, Wheeler Expedition, 1871. Coll. H. Strecker. Dr. H. Behr, Nevada.

Catocala Perdita. Hy. Edw. n. sp.

Very closely allied to the last species, and, but for Mr. Strecker's assurance to the contrary, I should have considered it identical. The transverse lines, however, are heavier, and the reniform spot is more distinctly gray in color. The mesial band of secondaries is wider, and continued further towards the abdominal margin. The apices are pure white, without any tint of rose color, and the amount of red on the lower side is very decidedly less than is to be found in *Faustina*. In other respects I can perceive no difference.

San Mateo County, Cal. (Coll. Hy. Edw.)

Catocala Hippolyta. Hy. Edw. n. sp.

Primaries, pale silver gray, the whole of the lines brownish, distinct. T. a., shaded with dark, particularly on costa. T. p., with the teeth very regular, almost in a line with each other, and of equal length. Reniform, brownish, indistinct. Sub-reniform, whitish, not connected with the t. p. line. Subterminal line, with regular teeth, but pale and rather indistinct.

Secondaries, yellowish red, same color as in *Parta*. Marginal, broad on apex, unusually narrow towards abdominal margin, where are two deep indentations. Mesial band, exceedingly narrow, widest in the middle, terminating very abruptly about two-tenths of an inch from the margin. Apices and marginations, slightly rosy. Fringe, white. Under surface, as in *Perdita*.

Head and thorax, gray, mixed with white. Abdomen, pale grayish drab.

Expanse of wings, 2.75 inch.

San Mateo County, Cal. (Coll. Hy. Edw.)

This is a beautiful and strongly marked species, the very pale gray of the primaries, and the remarkably narrow mesial band of secondaries, serving to distinguish it from any other with which I am acquainted.

Catocala Luciana. Hy. Edw. n. sp.

Primaries, brownish, gray, with yellowish tinge; the whole of the lines and spots very heavy and strongly marked, shading into black on the margin. Reniform, large, blackish, surrounded by paler ring. Sub-reniform, distinct, open, fawn drab.

Secondaries, yellowish red, color of *Parta*. Marginal band, rather narrow and regular, with only slight indentations near abdominal margin. Mesial band, also narrow, widest in center, and terminating abruptly about two-tenths of an inch from abdominal margin. Apices, with an orange tint. Fringe, yellowish white.

Under surface, yellowish white; inner half of secondaries, red; the bands, all narrow.

Expanse of wings, 3.00 inch.

Colorado, T. L. Mead. (Coll. Hy. Edw.)

Catocala Irene. Behr. (Trans. Am. Ent. Soc., 1870.)

Primaries, yellowish brown, paler along the margins. The lines are all indistinct, and lost in the brown shading of the wings. T. a., almost obsolete.

T. p., with two deep teeth, above the middle, directed towards the apex, and surmounted by a blackish shade. Sub-terminal line grayish, with regular teeth. Reniform, small, brown. Sub-reniform, almost obsolete, connected with a paler shade, which touches the costa.

Secondaries, yellowish scarlet, color of *Unijuga*. Marginal band, moderate, rather deeply toothed towards abdominal margin. Mesial, rather narrow, slightly constricted in the middle, and terminating in a point about one-eighth of an inch from margin. The under side of secondaries has an unusually large proportion of red.

Expanse of wings, 2.60 inch.

Fort Tejon, Coll. Br. Behr. Mendocino Co., Cal., Coll. Hy. Edw.

Mr. Strecker expresses some doubts as to the identity of my specimen with Dr. Behr's species, (Lepid. Rhop. et Heter., page 100) but, upon again carefully comparing them, I am convinced that they are alike, and in this opinion I am sustained by Dr. Behr. The species resembles *Unijuga* in the color of the secondaries, but it is much smaller, and is very widely separate in the ornamentation of the superior wings, which are browner and more confused than those of its Atlantic relative.

Catocala Marmorata. W. H. Edwards. (Proc. Ent. Soc. Phil., Vol. 2, 1864.)

"Expands 4 inches.

"Head and thorax, light gray. Abdomen, wanting.

"Upper surface. Primaries, pale gray and white, more or less powdered with dark gray or blackish atoms, and bear a superficial resemblance to the European *C. Fraxini*. Transverse lines, black. Beyond the t. p. line, a brown band, succeeded outwardly by another, which is much narrower, and pure white. Reniform, dark, and shape not well defined. Sub-reniform, joined by a line to, not formed by, a sinus of the t. p. line. Fringe, white.

"Secondaries, scarlet, of a lovely shade. Mesial band, narrowed in the middle, and extends almost to the abdominal margin. Fringe, white.

"Habitation, Yreka,, Cal."—W. H. Edwards, loc. cit.

Of this grand insect, apparently the largest of all known American species, I am entirely ignorant, save through the above description and Mr. Strecker's admirable illustration.

Catocala Stretchii. Behr. (Trans. Am. Ent. Soc., 1870.)

Primaries, silver gray, very distinctly mottled with black irrorations. Lines, all faint. T. a., whitish, and with very small teeth, running its length almost straight and without deviation. T. p. also nearly straight, and with even indentations. Reniform, blackish, with a double ring, and surrounded by a dark cloud. Sub-reniform, whitish, with a fawn-colored tinge; rather small but very distinct. Sub-terminal line runs parallel to the t. p.

Secondaries, yellowish red, paler than in *Parta*. Mesial band, very narrow, scarcely constricted in the middle, and turning into a very distinct hook about two-tenths of an inch from the abdominal margin. Marginal band nar-

row, with two small indentations near anal angle. Apices and marginations, very broadly white.

Thorax, gray. Abdomen, smoky drab.

Under side with usual bands, and half the secondaries yellowish red.

Expanse of wings, 2.85 inch.

Virginia City, Nevada, R. H. Stretch. (Coll. Dr. Behr.)

A very distinct species, of which the specimen in Dr. Behr's collection is the only one known to me. No other species has the hook of the mesial band so distinct as this, and the lines of the primaries are more regular and parallel to each other than in any other with which I am acquainted.

Catocala Aholibah. Strecker. (Lepid. Rhop. et Heteroc., Page 72.)

"Expands 3 inches.

"Head and thorax above, dark brown, with scattered white and gray scales. Abdomen, brown. Beneath, light brownish gray.

"Upper surface. Primaries, dark brown, frosted, and intermixed with white and gray; a white space adjoining the reniform, inwardly; reniform, indistinct; sub-reniform, very small, white, surrounded with black, and entirely disconnected with the transverse posterior line. Secondaries, crimson with brownish hair at the base; median band, rather narrow and regular, and continued to within a short distance of the abdominal margin, where it turns upwards, and is lost in the brownish hair that clothes that part.

"Under surface. Primaries, crossed by three black bands, none of which join or merge with each other; the spaces between the base and sub-basal band, and between the latter and the median band, are orange colored, inclining a little to crimson at the interior margin; the space between the median and marginal bands is white; fringe, white, with black at the termination of the veins. Secondaries, inner two-thirds, crimson, a little paler than on upper side; rest, white; marginal band, tinged with gray at and near the costa; median band terminates about one line from the abdominal margin; slight indications of a discal crescent, connecting with the median band; fringe, white.

"Habitation, California."—H. Strecker, loc. cit.

The above description was drawn up by Mr. Strecker from a ♀ presented to him by Mr. J. Behrens. The ♂, of which two specimens are in my collection, is smaller (2.60 inch.), the mesial band is wide, and reaches fully to the abdominal margin, while at the base of secondaries is a deep black shade formed by the hairs covering that region. The brown mottled shades of primaries are also much darker and richer, and the lines and spots more distinct.

C. Aholibah appears to be the most common of the Pacific Coast species, and is found from San Francisco to Vancouver Island, in which latter locality it is, as I have previously stated, quite abundant. It is by no means confined to the "higher mountains of California," as Mr. Behrens formerly imagined, that gentleman having recently taken a fine specimen at Saucelito, on the shores of our bay. I have received examples from Oregon and Washington Territory.

For the purpose of comparison, I am induced to add a description of the Mexican species spoken of at the commencement of this paper:

Catocala Cassandra. Hy. Edw. n. sp.

Primaries, dull gray, clouded with black. Lines, all distinct and regular. T. a., nearly straight, and with the indentations small. T. p., slightly bent on costa, with small and regular teeth, running obliquely from its center to interior margin, wanting the usual elbowed line, and reaching the margin behind its center. Sub-terminal line, almost obsolete. Reniform, black, surrounded by a black cloud, which reaches from costa to interior margin. Sub-reniform, whitish, indistinct.

Secondaries, pale red. Mesial band, narrow; of equal width for more than half its length, then abruptly narrowed, and bending almost at a right angle to abdominal margin. Marginal band, broad at the apex, with the indentations near anal angle moderate. Apices white, tinged with orange red. Fringe, white.

Under side. Usual bands, the mesial of secondaries terminating abruptly about two-tenths of an inch before reaching abdominal margin, and not continued to the margin as in the upper side. Inner half of secondaries, pale red.

Expanse of wings, 3.60 inch.

Guadalajara, Mexico, Baron Terloo. (Coll. Hy. Edw.)

Its large size, primaries clouded with black, and the peculiar form of the mesial band of secondaries, will serve to distinguish this from any other known species.

Section 4.

Secondaries, orange above, with black median band.

Catocala Zoe. Behr. (Proc. Ent. Soc. Phil., 1870.)

Primaries, rich brownish gray, mottled with white, the basal portion darkest. Across the center of the wing reaching from the base to the t. a. line, is a black dash, surmounted by some clear white scales. The t. a. is richly clouded with black, and only slightly dentate, chiefly towards the interior margin. T. p., black, with two large central teeth, and four smaller ones, of equal size, running towards the interior margin. The sub-terminal line is clear white, with the indentations small and regular. Reniform, large, whitish, surrounded by a double ring. Sub-reniform, very small in the ♂, large in ♀, open, and in the latter sex joining the t. p. line. Fringes, gray, mottled with brown.

Secondaries, bright orange, clouded at the base by brownish hairs. Mesial band, narrow, broadest in center, much constricted near abdominal margin, and there turned upwards, reaching the margin about its middle. Marginal band, moderate, very deeply bi-dentate near the anal angle. Apices and marginations, deep buff. Fringe, dirty white, alternated with brownish black.

Head and thorax, gray, mottled with white. Abdomen, smoky fawn color.

Under side. Usual bands, the lighter ones of primaries being largely suffused with orange, and the same color occupies nearly two-thirds of the secondaries.

Expanse of wings, 2.50 inch. ♂, 3.05 inch. ♀.

Napa and Marin Counties, Cal. Vancouver Island. (Coll. Dr. Behr. H. Strecker. Hy. Edw.)

This species very closely resembles both *C. Ilia* and *C. innubens* of the Atlantic States, but differs very materially from both in the pale color of the secondaries and by the more deeply toothed marginal band. The shading of the primaries very nearly approaches that of *Ilia*, but the lines are clearer, and more decidedly mottled with white.

It will thus be seen how very small is our present list of *Catocalæ*, compared with those of the Atlantic States, and yet, as the plants on which the caterpillars feed, viz., oaks, willows and poplars, are common throughout the State, we might reasonably look for an abundant harvest of species. Perhaps more collectors in the field, and a determined and energetic search for them in their haunts, will yield us a larger number of these beautiful moths, which at present, not alone in species, but also in individuals, may be ranked among the greatest of our entomological rarities. The following are noticed in this paper, the names of those which I have described as new having been derived from the heroines of Shakespeare's plays:

Catocala Californica	W. H. Edw.	
" *Cleopatra*	Hy. Edw.	n. sp.
" *Mariana*	Hy. Edw.	n. sp.
" *Faustina*	Strecker.	
" *Perdita*	Hy. Edw.	n. sp.
" *Hippolyta*	Hy. Edw.	n. sp.
" *Luciana*	Hy. Edw.	n. sp.
" *Irene*	Behr.	
" *Marmorata*	W. H. Edwards.	
" *Stretchii*	Behr.	
" *Aholibah*	Strecker.	
" *Cassandra*	Hy. Edw.	n. sp.
" *Zoe*	Behr.	

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PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

ANNUAL MEETING, JANUARY 3D, 1876.

First Vice-President in the Chair.

Thirty-seven members present.

Louis Nusbaumer and W. E. Burleigh were elected resident members.

On recommendation of the Council, Dr. Henry Gibbons, Sr. was unanimously elected an honorary life member.

In the absence of the President, First Vice-President, Henry Edwards, read the annual address as follows:

PRESIDENT'S ADDRESS.

It is a matter of regret that the coming of the New Year does not afford us the opportunity of welcoming back our worthy and respected President, who, on his return amongst us will doubtless have so much to say of the countries through which he has passed, and the many experiences which he has enjoyed. As circumstances will prolong his absence for a few weeks longer, it becomes my duty to address you on the progress which our Academy has made during the past year, and the hopes which

appear to be before us in the future. And the year which has just closed has indeed been for us an eventful one—the one from which, as it seems to me, our association will date its new life, and mark its strongest and most vigorous advancement. The Academy is poor no longer—the cloud of adversity which seemed so long to have overshadowed it, and which, but for the untiring energy and hopeful perseverance of a few of its members, would have brought its career of usefulness to a close, has, by the grand beneficence of one man, been entirely removed, and without indulging in too enthusiastic hopes, we may confidently look forward to be able to bask for the future in the sunshine of prosperity.

The change in the provisions of the Lick bequest is fresh in your recollection—a change most beneficial to us in every respect, which adds deeply to the debt of thankfulness we owe to him who has set so noble an example in the disposition of his wealth, and who has earned for all time the unbounded gratitude of lovers of science, not only in California, but throughout the whole civilized world. The property on Market Street deeded to us by Mr. Lick is now wholly in the hands of the Academy, the restrictions which existed in the former deed having been, as you are aware, entirely removed. Our annual income from this source will henceforth be in the neighborhood of $3,800, and it is to be believed that the rapid progress which San Francisco may be expected to make in the value of her real estate, will, in a few years, considerably enhance that sum. The number of members added to our list during 1875 has been twenty-seven, of whom two were life members. Some few have resigned, and we have lost four by death, viz.: Horatio Stone, B. P. Avery, W. C. Ralston, and B. F. Sherwood. Our total number of members is now nearly five hundred, seventy-eight of whom are Life Members, so that our monthly dues, should, if faithfully paid, bring us in about $5,500 per annum, making our total income a little over $9,000. It is a matter of regret, however, that many of our members are sadly in arrears, and the Council for the past year recently sent out notices to the whole of those who were deficient, stating that decided action will be taken in each case before the close of the year. It was, however, afterwards thought best to give these gentlemen an opportunity to pay their dues on the day of the annual election; but I

trust that the Council chosen to-day will follow up the intention of their predecessors, and at once drop the names of drones from the roll of membership. It would, I think, be advisable that a certificate of membership should be prepared and engraved for the Academy, to be presented to each member on his reception, and, that hereafter, the names of those who are discarded from our list in consequence of the non-payment of dues should be advertised in our proceedings at the end of the year; so that no one may be allowed to sail under false colors, and reap the benefits of the labors of those who are active and honorable members of the Society.

The Report of your Treasurer, which will be given to you in detail, shows a balance in hand of $1,593—and this, after paying for the printing of our publication of 1874, and the heavy expenses of altering this hall and supplying cases for our books and specimens. On the whole, therefore, our condition substantially is a satisfactory one; but I am able to speak in much higher terms of the scientific progress of the Academy, and the amount of work which has been accomplished. Our able director, Dr. Kellogg, has been absent for a part of the year, having been selected by the Government to make a collection of the woods of California for exhibition at the coming Centennial, which work he has most successfully performed. During his absence his place has been ably filled by Mr. W. G. W. Harford, who merits our warmest thanks for the interest he has always displayed in the Academy, and for the amount of industry he has brought to bear upon the duties of his position. We may congratulate ourselves upon his election for this year to the post of Director of the Museum.

Through the untiring energy of Mr. W. N. Lockington, nearly the whole of our Fishes, Crustacea, and Radiata, have been cleaned, identified and classified--a task which, apart from the scientific knowledge necessary for its performance, was one of very considerable labor, and a great tax on our fellow-member's time. Our collection of minerals, which now assumes considerable proportions, has been arranged and labeled by Mr. C. D. Gibbes, who has, during the past year, passed nearly the whole of his leisure time within the walls of this building. Our osteological collection, and especially our valuable series of crania, which for want of other room, are stored for the present in the basement, have been carefully cleaned, preserved and labeled, by

Dr. Stout, while our Birds have had the advantage of the supervision of Mr. F. Gruber, who promises, when cases can be found for them, to complete our series of California species and to make a MSS. catalogue of our collection, which may be published in our Transactions. To all these gentlemen whose labor has been cheerfully given, without stint and without thought of reward, the deepest gratitude of the Academy is due, and I am sure I have the authority of the members to convey thus publicly to them the expression of our truest and most hearty thanks. The donations to our collections have been both numerous and valuable—so numerous as to render it impossible for me to mention the names of all to whom we are indebted, though I cannot refrain from calling special attention to the many specimens of minerals received from various donors, including a fine set of New Zealand species, from Mr. McDevitt. Professor Eismark, of Christiana, Norway, has also enriched us by a present of European birds, Radiates and Crustacea; a fine collection of California woods has been presented by Mr. J. H. Clarke, of Mendocino; and from Dr. Burleigh we have received a valuable series of Alaskan Seals, both young and adult, in skin and in skeleton. Our corresponding member, Capt. J. H. Mortimer, has favored us with a beautiful set of pelagic Mollusca and Crustacea, including a specimen of the Portuguese Man-of-War, (Physalia Pelagica), most beautifully prepared, an object which, from its extreme delicacy, is rarely preserved, and therefore exceedingly scarce in museums. We have also received from various donors, large additions to our Shells, Radiates and Crustacea, all gifts having been duly and thankfully acknowledged. I trust that the importance of adding to our collection will not be lost sight of by members, and that all objects of interest which may come into their hands may be furnished to us for identification and preservation. As the whole of our treasures are gradually brought from the hiding places to which they have been too long consigned, we become more conscious of their extent and value, and the classification of the specimens which is now being proceeded with as rapidly as possible, will enable us to furnish information to those seeking it, and at the same time better display the desired genera and species of each department. It becomes, of course, a natural consequence that we should acquire duplicates of many

species, even after retaining full series in different stages of growth for the Academy's collection. To dispose of these to advantage is an object of paramount importance, and one to which the attention of the Council should be particularly directed. We especially need, to assist our already excellent collection of Crustacea, species from the Atlantic States, Europe, Africa and Australia. From the latter country and from New Guinea, we have every reason to hope for valuable contributions, and as our own Pacific Coast species are eagerly sought for by naturalists throughout the world, we may confidently expect that by a proper use of our duplicates, our number of species will, before the close of the present year, be certainly doubled. The same remark will apply in a greater or less degree to the other departments of Natural History, and I therefore urge upon all our friends, not to discard specimens because they may be thought to be common, as every one in good condition, whether existing in our series or not, is of value elsewhere, if not to us, and may be regarded as a gift of a new species to the Academy. For the proper display of our collections, however, more cases are immediately necessary, and as one of the matters most important to our interests during the present year, I urge upon the Trustees, as far as the funds at their disposal will allow, to take the subject of the display of all the materials in our possession into their serious consideration. A few hundred dollars judiciously spent now will give us case-room for some years to come, and the exhibition of our collections to the public, while it will not only assist scientific men in their investigations, will at the same time add an increased interest to our proceedings and draw from all quarters valuable contributions to our stores.

Our Library, under the able guardianship of Mr. W. J. Fisher, has considerably increased, and will shortly be rendered more accessible by a careful catalogue of every book and pamphlet upon our shelves, now being prepared by our Librarian, and intended to be subdivided into the different branches of study. We have received many important presents during the year, and I feel called upon to make special mention of the gift by our friend General D. D. Colton, of the most valuable series of Entomological works, including those of Hubner, Cramer, Drury and Stoll, all of which are profusely illustrated, and are of incalculable interest to students in that branch of science. To him,

as well as to all who have assisted us, our hearty thanks are most cheerfully offered.

The various papers which have been presented to the Academy have been of more than common interest, and will add very much to the value of our printed records. Among them I may be excused from mentioning two by our President, on the "Abrasion of the Coast of Japan," and "Probable cause of the low temperature at great depths of the Ocean." Mr. C. W. Brooks has given us precious information in his essays upon "Japanese works in American waters," and the "Commerce of Prehistoric races," while upon more special topics, we have had interesting papers from Dr. Kellogg, on the "Species of Eucalyptus," and on "Loco poison;" from Dr. Jos. Le Conte, on the "Ancient Glaciers of the Sierras;" from Mr. Amos Bowman, on the "Coal deposits of California;" from Dr. Cooper, on the "Land shells of the Coast;" from Mr. Lockington, on "Various species of Crustacea;" and from Drs. Blake and Behr, "Observations on the Phylloxera." Other matters have also been brought to your attention, to which it is hardly necessary for me to allude, as they will soon be before you in a published form, rendering the next volume of our Proceedings, in point of interest, nothing behind its predecessors.

The "Botany of California," the result of the labors of the Geological survey, will soon, through the public spirit of a few generous men, be given to the world, and it would be unbecoming in me if I did not here publicly express to Messrs. Leland Stanford, Lloyd Tevis, J. C. Flood, R. B. Woodward, Henry Pierce, D. O. Mills, Jno. O. Earl, Wm. Norris, and C. McLaughlin, the debt which all lovers of science owe to them for their noble munificence. Nor should our obligations to the scientific men who have had charge of the enterprise, and to whose knowledge of the subject we are so much indebted, be ever forgotten. Professors Asa Gray, J. D. Whitney, Watson and Brewer, have each and all devoted much time and labor to the work, and will always be entitled to the gratitude, not only of the members of this Academy, but of the future generations of scientists who may investigate the beautiful study of which they are such distinguished teachers. To Professor Gilman, also, whose absence is his gain, but our loss, we must render our thanks for the en-

* To Judge S. C. Hastings the gratitude of the Academy is also due, as it was owing to his exertions that public attention was first called to the necessity for this publication.

terprise and ability which he displayed in advancing the publication of these much needed and deeply interesting volumes.

And here allow me to say, that it may be confidently hoped that the present session of the Legislature will take a generous and extended view of the scientific requirements of our age, and see fit to revive the Geological Survey, thus completing its previous work and bringing its former labors into active usefulness. I know that this question is viewed by different minds under different aspects, and that there are many well-meaning people in the State who will regard such a movement with disfavor. This arises partly in consequence of the want of practical value of the achievements of the survey so far as it has gone, and partly from the utter inability of some minds to appreciate the use of scientific work altogether. With the latter class it is useless to argue. Time and results alone can effect a change in them. But the former may candidly be allowed to have some just cause of complaint, the economic wealth of our State not having been, in the comprehensive views of the chief of the Survey, yet reached in the plan he had laid down; but in the future, if the government of the State should see fit to grant a sum for the continuance of the Survey, it may be entirely within its province to say for what particular ends that sum is granted. If money be given for a special purpose, it is only fair that the giver should have something to say about the carrying out of the work; and if it should be deemed that a volume on the economic geology of the State, or on the insects injurious to agriculture, would be, as suggested by the press, of more immediate and personal benefit than one on paleontology, I fail to see the unreasonableness of the demand that these subjects should at any rate be first perfected and given to the people. The rest of the work would most assuredly follow in good time, and, year by year, it is hoped that our legislators will feel more interest in the pursuits and needs of scientific culture, and that the grandeur of their schemes lies not in looking to the immediate time, but stretching in its operation far out into the future, it expands into its fullest power and conveys its perfect influence to the generations yet to come. It is, I believe, intended that the matter of the Survey will be brought on its merits before the present Legislature, and I only thus briefly allude to it here to place on record the opinion of this Academy, as the representative of the

scientific energy of this coast, and its earnest desire to see so valuable a work brought to fruition—a work which, in California more than in any other State in the Union, seems marked out as the most important educational need of the people.

It appears to me, with reference to a plan for our future work, that the course adopted by the natural history societies in the Atlantic States and Europe, may with advantage be followed here. This is the sectionizing our labors, so as to bring more determined and persistent endeavors to each individual subject, and by concentrating our energies on certain given points, be enabled to accomplish more than we can ever do while our labors are so diffused. Thus we might have a geological section, a botanical section, an entomological section, and so on, the object of each of which should be earnest and energetic work in its particular department of study, and the formation of special collections belonging to each branch. No qualifications should be required for membership in these offshoots of the general body, beyond the fact that work will be expected from all, it being of course understood that the workers in all cases shall be members of the Academy. There is abundant strength in organization, and I should suggest that a chairman and secretary should be chosen out of the members of each section, that a faithful record of all proceedings, no matter how trifling they may appear, should be kept; that the members should meet at least once a week, and that all original papers should be then first submitted, and if deemed worthy of acceptance, should be read at the fortnightly meetings, and then find a place in our proceedings. We should thus, if such a course were persistently indulged, secure an interest for the general meetings which they now rarely possess, and should make our labors of more advantage to students than they can possibly now be. There is nothing in the Constitution to prevent immediate action on this subject on the part of the members, and I think the suggestion will be found to be well worthy the attention of the Academy. It may be deemed necessary, among the several branches, to have a small weekly subscription, if only to the amount of ten cents per week, for the purchase of periodicals, apparatus, etc., without encroaching upon the general fund; but of this I do not speak authorita-

tively, as many details may yet have to be arranged, and experience will be the best teacher as to our wants.

It is agreeable to observe a change in the manner which certain journals of the city have assumed toward the Academy in their reports of its meetings. Some time since it was too much the custom to sneer at our deliberations, and attempt by some ill-judged witticisms to underrate their importance; but of late careful and respectful attention has been given to what passes here, and a more considerate tone has been taken by those representatives of the press who were once wont to assail us with unfair criticism. Science, no less than literature, aims at the elevation and refinement of mankind, and her struggles for the progress of the race should be encouraged by all who value the welfare of their fellows. And if my feeble words may reach the moneyed men of California, I would say to them that a field of benevolence is open to them, on which some of their surplus riches may be spent, which is fraught with incalculable advantages to the rising generation. I mean a thorough and scientific exploration of this most interesting country, and the collection of specimens in all branches of natural history, so that a museum of the Pacific Coast worthy of the name may find its home in San Francisco, and the riches we possess at our very doors may be brought together for preservation and for after use, instead of being now transmitted to Europe and across the continent to enrich the collections of older and wiser communities than ourselves. It is true that much has already been done by private investigation, but after all the bulk of the work remains undone. Naturalists as a class are invariably poor, and need help from their more fortunate brethren. In the single matter of Indian relics alone, the field is almost infinite, the late expedition to Southern California, under Lieutenant Wheeler, taking from the neighborhood of Santa Barbara over thirteen tons weight of these interesting memorials for exhibition at the Centennial. These will find their way into some of the museums of the Atlantic States, and be regarded as among the most valuable of their deposits, while California tamely allows herself to be deprived of objects which should surely be under her care alone. In every branch of natural history, too, the same remarks will apply. Our species have in many instances, for the want of literature or a full series of specimens, been sent elsewhere to be described, and the original types

are consequently lost to us; but with a band of workers under the sectionizing system which I have previously suggested, this may be avoided, provided the material for comparison and complete study of individual groups be placed within our reach. Handbooks of the various families in each branch of natural history could then be cheaply published, and throughout the State an impetus would be given to the study of nature which no other means can furnish. A few thousand dollars thus expended would place the givers high upon the pinnacle of fame, and hand their names down to those who shall come after us as worthy of respect and their deeds as worthy of imitation. In a community like our own, where riches seem to fall unsought into the laps of their possessors, it is well to inculcate the thought that not alone upon the battle ground of wealth can the victory of life be won; that there are triumphs purer and more abiding than worldly treasure, more powerful in their influence for humanity, than the grandest display of personal aggrandizement, and more calculated to sink deeply into the character of the coming ages, than the amassing of riches, unprofitably distributed, can ever do. Individuals have done much good in aiding the *material* progress of our State. Can some few be found to assist her *intellectual* advancement, and to make bright the toilsome path of science with the beacons of their kindly succor?

HENRY EDWARDS,
First Vice-President.

David D. Colton, President of the Board of Trustees, presented his annual report, which was read by the Secretary, as follows:

To the Trustees and Members of the California Academy of Sciences:

This being the close of the first fiscal year under the new organization of the Academy, it would seem proper for me to give a brief statement of the condition of the "temporalities" of the Academy, which by our new Constitution comes exclusively under the control of the Board of Trustees.

The Treasurer's report shows that at the commencement of the present year we had on hand $2,900, and that the present condition of the treasury shows $1,593.73 now on hand.

All matters in the way of expenditures have been carefully scrutinized, and the greatest economy maintained in all matters pertaining to the expenses of the Society. It will be observed that we have considerably reduced during the year the amount of cash on hand. Some purchases and expenditures connected with the alteration of the building in which we meet seemed unavoidable, and we feel certain that the improvements made as the result of this expenditure will be justified by the members of the Academy.

It is with a degree of great satisfaction that we are able to report to the Academy that we have taken possession of the munificent donation of land on Market street, in this city, from Mr. James Lick, he having given us the title, absolute in fee, to the same, which had heretofore been conditionally deeded by him with such restrictions as left grave doubts in our minds as to whether the gift would ever be of any practical utility to the Academy. The amount of rents per annum derived from the property at the time we received the same, were about $2,300. These have been increased nearly 100 per cent., and we feel justified in the expectation that this property, for the coming year, will produce us gross about $5,000; and from the most reliable information, taken in connection with the provisions in our favor in the last deed of trust as executed by Mr. Lick, we are warranted in the belief that this princely gift will enable the Academy to erect on the ground, within a few years, one of the most magnificent temples of science on the face of the globe.

It has been a matter of regret that we had not a more extensive fund to draw from for purposes of publication, and that so important a branch has been unavoidably curtailed for want of sufficient funds to justify publications which we have been compelled to omit. As the report of the Treasurer shows, a large number of members have defaulted in their dues. Had those payments been made, it would have materially assisted our publication fund.

It is but justice to Mr. H. M. Newhall to say, that his liberal donation during the past year of $1,200, to be applied on the rent, has been of great assistance to us, and we feel he deserves the thanks and gratitude of the entire Academy.

To the Trustees I return my sincere thanks for their prompt attendance on all the regular and many special meetings during

the year, and for the deep interest manifested by all of them in the prosperity of the Academy, and for their jealous care and watchfulness for its best interests.

It is but justice to the Secretary, Mr. C. G. Yale, to say that for his promptness at all our meetings we are very thankful.

I remain, very respectfully, yours,

DAVID D. COLTON,
President Board of Trustees.

The Recording Secretary, Charles G. Yale, read the following annual report:

To the President and Members of the Academy:

As Recording Secretary of the Academy during the year 1875, I have simply to report what relates to new members, papers presented, and attendance at meetings.

The total attendance of members at meetings during the year has been 842, an average of 31 members at each meeting.

Twenty-seven new members have been elected, four have died, and three have resigned. The total resident membership is now 301, and the life members number 78. A list of those who became members in 1875 is appended, as well as a list of the forty-one papers read during the year, with names of authors, etc.

CHARLES G. YALE,
Recording Secretary.

Wm. J. Fisher, Librarian, presented his annual report, giving the condition of the library, as follows:

REPORT OF LIBRARIAN.

Mr. President and Members of the Academy:

During the past year our Library has received considerable additions, as well by our usual regular exchanges, as also by donations from individual members of our Society.

Especially are we indebted to our former fellow member, Professor Gilman, for a large collection of works on History and Geography, and to General D. D. Colton, for a number of very rare and costly works on Entomology.

During the latter part of the year, the Library has been removed from its former position in the gallery to its present place, and, by order of the Trustees, a number of new cases have been constructed for the accommodation of the rapidly increasing material.

I have completed the Catalogue of the works in the Library pertaining to the different scientific departments, and am now engaged in cataloguing the Proceedings received by us from sister societies.

In pursuing this work, I find a vast number of duplicates, and of works not strictly of a scientific character. A great many of these books are valuable, and I would respectfully suggest that authority be given to dispose of them, either by sale or exchange.

I also beg to call the attention of the Academy to the fact, that a considerable number of very valuable works require binding, and that by neglecting this important duty heretofore, a great many of these works have become defective.

I enclose a list of such literature as, in my opinion, should receive this attention at once, and hope that a sufficient sum will be appropriated for this purpose without delay.

A great mass of new material received by the Academy is left undescribed, for want of the proper literature, compelling us to leave to other Societies, better supplied in this respect, the honor of describing and publishing in their Proceedings, articles which otherwise would have found a space in our own Proceedings.

The following standard works, carefully selected, ought to be added to the Library as soon as possible, viz:

Ichthyology and Herpetology.

Gunther's Catalogue of Fishes; Catalogue of Apodal Fishes; Catalogue of Shield Reptiles.

Zoology.

Catalogues of Mammalia.

Crustacea.

Milne Edward's Histoire Nationelle des Crustacea; Dana's Crustacea; Bate and Westwood's Brit. Sessile-eyed Crustacea; Bell's Brit. Stalk-eyed Crustacea.

Radiates.

Forbes' Brit. Star Fishes; Johnson's Brit. Zoöphytes.

Protozoans.

Bowerbank's Brit. Sponges.

Osteology.

Huxley's Elementary Atlas of Comparative Osteology.

Ornithology.

Baird, Brewer and Ridgeway's History of N. A. Birds.

Botany.

De Candolles' Prodromus.

Our Ethnological department is at present very meagre, comprising only a few pamphlets and proceedings of foreign Ethnological Societies. I would suggest that the work lately issued by our fellow townsman, Mr. H. H. Bancroft, on "The Native Races of the Pacific States," which has been very highly commended, as well by scientific men here as abroad, be secured for this department.

Very respectfully,

WM. J. FISHER,

Librarian.

The Director of the Museum, Dr. Albert Kellogg, reported on matters under his charge, as follows:

REPORT OF DIRECTOR OF THE MUSEUM.

As Director of the Museum of the California Academy of Sciences, it is but just to say, at the outset, that the improved order of arrangement witnessed by you, was inaugurated, supervised, and mainly executed, with distinguished zeal and ability, in my absence, by Mr. Harford, my improved substitute and Director *pro tem.*—of course, by and with the consent and coöperative aid of others. For my part, I candidly confess the idea of temporary occupancy had, to some extent, weakened my enterprise in the direction of pressing necessities. With this new field of space utilized, I trust we may be able to furnish it with the needed cases. If we can only provide the books and means to identify and care for collections, the men, as curators and members of all work, will see that there can be no cause of complaint at the close of 1876.

I am aware that we have little means to expend; but if our urgent wants were known, it might lead to the ways and means.

In the department of Minerals, the past year, we have received 340 donations.

Mr. Chas. D. Gibbes, whose singleness of purpose, and hearty sympathy has ever been steady to the Academy's interests, failing to arouse a proper zeal in behalf of this department, at length determined to see some system inaugurated, of more pratical utility to the miner and general enquirer. While the strictly scientific arrangement of the Curator was not in any way disturbed, he has bestowed great labor and ability in sectionizing the department, according to Countries or Nations, States and Counties, thus facilitating special reference. Now, a person desirous of visiting a certain section, can seek and readily find sectional information; or, if more time is at his command, and not satisfied with this localized cabinet, he may search the general cabinet. This special system is somewhat similar to an immense promiscuous volume, well indexed, and to some extent topographically sectionized, while the other affords no such bird's eye facilities; but to execute the plan well, needs much room. With the coöperative contribution of Mining companies, only abating the merest iota of the monster specimens so zealously sent abroad, in less than a year this system could be adequately established.

We have many wealthy members offering us subscriptions for timber, bricks, and mortar, to the extent of thousands of dollars. Now, seeing this is no longer needed, why not pay a trifle—of course, selecting their own way of doing it—to such parties as they may choose to invite to their expedition, as canvassers and collectors, etc., and let them visit the mines, etc., and so be accredited for their collections, *e. g.*

This age is already deciding that the best monuments are those most useful, and such will be the wise decision of posterity.

It is high time to be preparing and arranging our cabinets for the new

building. Many of these specimens have been so long packed away, as to render the tags illegible.

Tons upon tons of minerals, fossils, and prehistoric relics, are journeying towards the rising sun, obedient to Eastern enterprise. Nor need we wish there were less, but that many might also find a home here, where scientific data are also prized; though the sacred proverb reminds us that the worthy prophets are not without honor, save in their *own* country.

Donations of *Crustaceans* during the year, are 57; Radiates, 21; Fishes, 22; Reptiles, 6; *Vermes*, 2; *Arachnidæ*, 3; *Myriapoda*, 23. Only a very remote idea of the work done, can be obtained from the Director's Catalogue of Contributions. Mr. Lockington has labored with commendable zeal, as the details of his department manifestly show. With the requisite books of reference, tenfold more may be accomplished with a little of the toil called forth last season. We trust all such indefatigable workers will be afforded needful aid.

In the department of Birds, Mr. Gruber informs me, about 150 have been donated to the Academy. About one-half of the collection have been classified and catalogued, but, owing to the confusion of recent changes in the names, etc., it was deemed advisable to await American authorities, so much needed. These have been added without any cost to the Academy, which is indeed a large contribution.

In Botany, 120 donations. The Curator of this department has left everything in *statu quo*. Two paid curators employed a year, could not identify, classify, and poison the Herbarium, nor can we hope for any one without ample means of support, to undertake it; yet more, at least, than last season, ought to be expected.

The Mammals, 5 were kindly cared for by Mr. Gruber.

The donations of Shells amount to 69; Insects, 1; and Miscellaneous, 25.

As matters of special notice, it is due to say, that Dr. Burleigh has donated the skeleton of a seal, which, when able to set up properly, will add much to the scientific and general interest of the Academy.

Dr. A. B. Stout has also expended much labor and care in neatly cleaning and preparing a rare and varied collection of anatomical specimens for the Museum, for which the Academy are under many obligations.

Rev. E. R. Greene has also furnished us with a fine collection of well identified plants, from Colorado and the interior, which have not been distributed, and therefore do not appear in the enumerated catalogue.

It should be stated that other large and valuable collections have been received *en masse*, and not being opened, have simply passed on the list as one presentation. It would be better, hereafter, to open, enumerate, and if need be, repack such ample contributions, in order that the record may be historically more useful, and more full and just to our patrons. This was intended in all cases, but many who were competent to label and distribute them properly, having given us their promise to do so, from press of private business or other causes, failed to aid us. We trust that neither our successor, nor future contributors, may ever have any such just cause of complaint.

Respectfully submitted,

A. KELLOGG,

Director of the Museum of the California Academy of Sciences.

The Board of Trustees presented, through the Secretary, a statement in detail of the receipts and disbursements of the year, presenting vouchers of same, with monthly abstracts, checks and accompanying papers. The annual report was as follows:

ANNUAL STATEMENT OF THE BOARD OF TRUSTEES.

Amount in Bank of California, February 20th, 1875, at time Board of Trustees for 1875 took charge of disbursements		$2,900 00
Sundry deposits to date		1,769 78
Retransferred from London and S. F. Bank to Bank of California		1,293 00
Expenditures in Museum for cases, shelves, repairs, alcohol, bottles, etc	$ 558 55	
Salaries and Commissions to Curator of Museum, Secretary of Board of Trustees, and Treasurer	1,021 15	
Rent	1,650 00	
Expense account, (including fuel, cleaning, etc.)	142 40	
Advertising meetings	32 80	
Printing, (including Proceedings, blanks, checks, vouchers and abstracts, receipts, postal cards, labels and tags for Museum, engraving for Proceedings, etc.)	679 89	
Stationery and Binding	98 04	
Freight, C. P. R. R.	6 70	
Water	6 00	
Repairs to Building, (Gas Fixtures, Mending Roof, etc.)	132 92	
Periodicals for Library	40 60	
Total Expenditures, 1875	4,369 05	
Balance in Bank, December 31, 1875	1,593 78	
	$5,962 78	$5,962 78

The Trustees desire to add to this annual statement the fact, that of the above expenditures, the sum of $819.29 was for indebtedness incurred by their predecessors in office. The details of these expenditures are as follows:

C. E. Boman, fixing shelves in Museum	$ 129 00
Bacon & Co., printing Proceedings of 1874	265 55
Bacon & Co., printing Proceedings of 1874, (minus $12 for this year's work)	261 84
Advertising	21 75
Springer, (Lumber)	11 55
Contingencies of Curator in December, 1874	35 50
Curtain bought for Museum	3 50

Periodicals furnished	$40 60
Dewey & Co., Engravings for Proceedings 1874	50 00
	$819 29
Total this year	4,369 05
Deduct last year's Bills (1874)	819 29
Leaves as Disbursements by present Board of Trustees	$3,549 76

A communication was received from the Board of Trustees, suggesting that a vote of thanks be given to certain members of the Academy for gratuitous work performed during the year. On motion, in accordance with the suggestion, a vote of thanks was passed to the following gentlemen: W. N. Lockington, W. G. W. Harford, C. D. Gibbes, W. J. Fisher and A. B. Stout.

The report of the Treasurer was read by the President, giving the amount of collections made during the year.

On motion, the reports of all the officers were accepted and ordered printed in the proceedings.

The report of judges and inspectors of election was received and accepted. A vote of thanks was passed to these gentlemen for the faithful performance of their duties.

Their report showed the following as the result of the annual election:

PRESIDENT,

GEORGE DAVIDSON.

FIRST VICE-PRESIDENT,

HENRY EDWARDS.

SECOND VICE-PRESIDENT,

HENRY C. HYDE.

CORRESPONDING SECRETARY,

THEODORE A. BLAKE.

RECORDING SECRETARY,

CHARLES G. YALE.

TREASURER,

EDWARD F. HALL, Jr.

LIBRARIAN,

W. J. FISHER.

DIRECTOR OF MUSEUM,

W. G. W. HARFORD.

TRUSTEES,

D. D. COLTON,
JOHN F. MILLER,
THOS. P. MADDEN,
R. E. C. STEARNS,
WM. ASHBURNER,
GEORGE E. GRAY,
RALPH C. HARRISON.

On motion of Mr. Ashburner, the Vice-President was authorized to appoint a Committee to take into consideration the matter of sectionizing the Academy, to report at the next meeting.

REGULAR MEETING, JANUARY 17, 1876.

First Vice-President in the Chair.

Thirty members present.

Z. W. Greene and Dr. Murphy were elected resident members.

Donations to the Museum: From Henry Edwards specimens of *Sebastes nebulosus*, *Psettichthys melanostichthys*, *Sebastodes flavidus*, *Pleuronichthys marmoratus*, *Embiotica lineata*, *Metrogaster aggregatus*, *Bryttus*, sp? *Octopus punctatus*, *Lithogphagus*, sp? Also botanical specimens as follows: *Abies Pattoniana*, *Pinus flexilis*, *Pinus tuberculata*, *Pinus monticola*, *Librocedrus decurrens*. From the same donor was received a specimen of *Actinemys marmoratus*. Mr. W. G. W. Harford presented specimens of fish as follows: *Chiropsis nebulosus*, *Sebastes ruber* and an Alcyonoid polyp. Dr. R. K. Nuttall presented specimen of *Ostracion*, and Mr. W. G. Blunt five specimens of Eutænia. Mr. W. N. Lockington presented a specimen of *Caprella Californica*. Minerals were received as follows: From T. H. Folingsby six vials containing a number of precious garnets; one vial red and green garnets; one vial with ten specimens, supposed to contain black diamonds; one vial with quartz crystals; and one vial of green and white quartz—all from Choco, New Granada. F. A. Walley presented a specimen of Calute from near Martinez. Dr. Stout presented specimen of building stone from near Petaluma. From G. W. Sanders five specimens petrified wood and charcoal. From C. D. Gibbes fibrous asbestos and mica from Ruby Valley, Nev. From G. B. Merriam granite from Young's Temple, Salt Lake. From T. H. Sacket three specimens chalcedomy from Temescal, Alameda County. From J. H. Mortimer bog turf, Galway, Ireland. From Henry Edwards silver ore, Panamint, Inyo Co., Cal.

C. B. Turrill read a paper by Chas. Wolcott Brooks recom-

mending a course of popular scientific lectures before the Academy. Mr. Turril read a supplementary paper on the same subject.

Henry Edwards read a paper on Pacific Coast *Lepidoptera*, No. 16.

Pacific Coast Lepidoptera.—No. 16. Notes on the Transformations of some Species of Lepidoptera, not hitherto recorded.

BY HENRY EDWARDS.

With the desire to add, little by little, to the knowledge of our species of Lepidoptera, I think it of importance to present to entomologists every observation which I am enabled to make with reference to their transformations, and though in some instances I am only able to give notes of the egg, in others, of the early larval stage, and still in others, of the more mature conditions, I regard these as of extreme value in assisting to perfect our knowledge of the life-history of each species, and as an aid to other workers who may have opportunities different from my own. As the paleontologist can, from the fragmentary portions of extinct animals, sometimes obtained from regions remote from each other, build up a complete description of the species under his consideration, so do I hope that these incomplete studies may aid the future student of the habits and history of our yet slightly known insects, and thus become the foundation upon which a better superstructure may be raised. The whole field of research in this department is yet untraversed, and will amply repay the investigator in this most interesting branch of natural science, and as before, I entreat those into whose hands examples of the early stages of any of our insects may fall, to omit no opportunity of making known to myself, or others engaged in entomological pursuits, the results of their observations.

Since the publication of my last paper on the transformations of our Lepidoptera (No. 14), the following species have come under my notice:

Family PAPILIONIDÆ.

Papilio Philenor. *Fab.*

Chrysalis. The usual color of this stage of Philenor has been a grayish stone color, mottled with violet and yellow; but from two caterpillars found feeding, in June last, on Aristolochia at Saucelito, I have obtained chrysalides so different in color, as almost to suggest another species. They are pale, but vivid, yellowish green, of a very lively tint over the whole surface, which is covered with minute blackish reticulations. The edges of the wing cases, abdominal tubercles, apex of the mesonotal process and edges of the antennæ cases rich purplish brown. Out of the same brood of thirteen caterpillars, eleven assumed the normal coloring. They all went into the chrysalis state from June 28th to July 17th.

Fam. NYMPHALIDÆ.

Limenitis eulalia. *Bdv.*=*Californica.* *Butler.*

Larva. General color, pale greenish or fawn color, becoming entirely of the latter tint when about to undergo its change. Body covered with small whitish spines. Head rather large, edged on its margins with a row of slightly branched whitish spines, each tipped with black; 2d segment constricted, without spines; 3d, 4th, 6th, 11th and 12th, each with a pair of long and branched spines, tipped with black; 7th, 8th, 9th and 10th, with shorter pair of similar spines. Below the spiracles, which are fawn color, is a darker line. Feet and legs concolorous.

Length, 1.20 inches.

Food plant, *Quercus Douglassii*, *Quercus Sonomensis.*

Chrysalis. The specimens from which my first description was taken (Proc. Cal. Acad. Sc., Vol. V, Part II) differed from the present one, in that the latter had a most beautiful pale golden blotch over the whole region of the wing cases. This chrysalis was semi-transparent, ash gray or drab, and was attached to the under side of the oak leaf by strong silken threads; the whole of the surface of the leaf being covered by the web.

Changed to chrysalis, August 20th. Imago, September 3d.

Fam. LYCÆNIDÆ.

Lycæna antægon. *Bdv.*

Larva. Head small; dark brown. Body dirty yellow, covered with very short downy hairs; a few black spots irregularly scattered, and a narrow greenish dorsal stripe. Spiracles, small; dark brown.

Length, 0.50 inch.

I am indebted to Dr. Behr for an opportunity of observing the larva; specimens having been found by Mr. Graham, one of Dr. Behr's students, feeding in the pods of *Astragulus.*

Fam. SPHINGIDÆ.

Deilephila daucus. *Cram.*=*Lineata.* *Fab.*

Larva. Mature. General color pale apple green. Head and 2d segment with more olivaceous tint, thickly dotted with greenish white warty spots. Mouth parts, dull yellowish. There is a bright green dorsal line, varying much in width in different individuals; sometimes merely a line, at others occupying nearly the whole dorsal surface. This is uneven at its edges, which merge into black subdorsal lines, enclosing a bright yellow streak. Both the black and yellow lines are widest anteriorly, the latter in some specimens becoming an orange patch. Posteriorly on the black lines are some small yellow dots. Caudal horn dull yellow, rough, black at the tip. Anal segment similar to the head. Spiracles orange, surrounded by a black patch, in which are some small yellow dots. Above the feet, which with the legs, are dull yellow, are some waved black lines, occasionally obsolete.

Variety. After the fourth moult, the caterpillar sometimes, but only rarely,

assumes a very strange appearance. It becomes quite black, every trace of green being lost. The head and anal segment are then bright chestnut brown. with paler dots; while the feet and legs are dark orange. There is a faint trace of a yellow subdorsal line, and the spiracles are dark orange, with a faint lateral line below them. Between their extremes are many varieties of color.

Chrysalis. Very long and cylindrical; light chestnut brown, Tongue case wanting. Head and wing cases entirely without irrorations. Abdominal segments darker posteriorly, very rough, and dotted with darker points. Spiracles large, ovate, dark brown.

Length, 2.10 inches Width, 0.40 inch.

The caterpillar feeds on *Rumex*, *Epilobium*, *Pelargonium* and *Fuschia*. To the last named garden plants, it is extremely destructive. It is full-grown in June; changes to chrysalis from that month to the end of July, burying itself rather deeply in the ground. The perfect insect appears from August to October. It is quite common in gardens throughout this State.

Smerinthus opthalmicus. Bdv.

Egg. Deposited separately on the food plant. Ovate, cream yellow, very smooth and shining, surrounded by a ring of lake red color. Before the exclusion of the larva, the eggs change to a pale, and afterwards to a dull greenish blue, the reddish ring being lost. Deposited, July 20th, on willows.

Young Larva. Emerged July 28th. Very pale yellowish green. Head very large, almost monstrous, and of a darker shade. Caudal horn pinkish brown, darkest at the tip. After the second moult the oblique yellow stripes make their appearance, and there is then little change save in size, until the

Mature Larva. General color pale apple green. Head rather large, truncate in front, pyramidal, the two sides of the angle broadly and distinctly edged with bright yellow, and enclosing a corrugated space, darker green than the rest of the body. Mouth parts, and feet reddish brown. The whole of the segments are marked with whitish tubercular dots. Along the sides is a narrow stripe of pale yellow, and from the 4th, 5th, 6th, 7th, 8th, 9th and 10th segments proceed some oblique yellow stripes, the 10th being the broadest, and continued to the junction of the caudal horn, which is dull sky blue, the extremity black. The anal segment is also edged with yellow. Spiracles white, edged with reddish brown. Abdominal legs, dull apple green.

Apparently double brooded, as I have taken fresh specimens of the perfect insect in February and March, while the specimens from which the above description is drawn, went into chrysalis in July, the moth emerging in the middle of September.

Fam. BOMBYCIDÆ.

Halesidota Edwardsii. Packard.

Egg. Laid in irregular clusters. Ovate, slightly flattened at the apex, and often forced out of its regular shape by a large mass being crowded into the fissure of the bark chosen as the place of deposition. Color, dull yellow, paler on the upper half, and there slightly transparent. There is no apparent sculpture, the whole surface being quite smooth and shining.

The young larvæ, which are quite black, with very long hairs, appeared on May 5th, the eggs having been deposited on April 24th. The mature form of the larvæ is described in Stretch's "Zygæindæ and Bombycidæ of North America," page 88.

Spilosoma vestalis. Packard.

Egg. Laid in compact masses upon the food plant. Color, cream white, surface slightly wrinkled, the wrinkles when viewed through a powerful lens appearing to be a series of punctures. Eggs deposited May 15; larvæ emerged May 21st.

Young Larva. On exclusion from the egg the larvæ are dirty greenish black, with the head large, and the hairs remarkably long. After second month, the body becomes whitish green, with the head slightly pitchy. The 2d, 3d, 4th, 6th, 7th, 8th, 9th and 10th segments have four small blackish tubercles, armed with whitish spines laterally, and blackish ones dorsally. The 5th and 11th segments have still larger black tubercles. The dorsal region is darker than the sides, which generally have a yellowish tint. Feet and legs, greenish white. After the third month, the whole of the lateral hairs become bright chestnut brown, almost deep orange; those of the dorsal region darker brown, and beyond the 4th segment anteriorly, and the 10th posteriorly, the hairs of the dorsal tubercles are black; the tubercles also become hidden by the hairs. Subsequent to the fourth moult, the whole of the dorsal hairs are largely and broadly black, and the lateral series bright chestnut brown. In this condition, the larva may be readily mistaken for that of *Spilosoma acrea*.

Mature larva. Body slate black, glossy. Dorsal bunches of spines, rich velvety black; those of the lateral region, bright chestnut brown; underside, ash color. The spines are all very glossy and rich in color.

Length, 1.75 inch.

Food plant, various sp. of *Lupinus*.

The larvæ were fully fed in the early part of July, being exceedingly voracious, though able to exist for four or five days without food, and suffering no apparent inconvenience. About the 10th of the month, they began to spin cocoons, mixing up with their webs the remains of leaves and stems of their food, the whole of eleven larvæ which I carried successfully to their last stage, changing almost on the same day to the condition of chrysalis. The perfect insect is usually met with in April, and in warm seasons as early as March.

Pseudohazis eglanterina. Bdv.

Egg. Ovate, stone color, agglutinated together, and arranged in a compact mass around the stem of the food plant, generally near the extremity of the branches. The eggs are attached by their smallest end, the larvæ escaping from the apex.

Mature Larva. Head black, shining, with a few short, brownish hairs. Body entirely dull black. Each segment is armed with six lateral spines, very finely branched, and two dorsal fascicles of spines, bright chestnut color, blackish in the centre. The branchlets of the spines are all bright

chestnut color. Underside, as well as the feet and abdominal legs, dull black.

Length, 2.00 inches.

Food plants, *Frangula Californica*, and various species of Rosa.

Hemileuca Nevadensis. Stretch.

Head shining, reddish brown. Body, pale citron yellow; 2d segment with reddish brown transverse streak, armed anteriorly with six black spines, having pale yellow branches; 3d, 4th, 5th and 6th segments, each with eight spines; 7th, 8th, 9th, 10th and 11th, have six spines each; 12th and 13th, only five, the middle one of the last being placed posteriorly to the other four. The whole of the lateral spines, as well as those of the 13th segment, are black, with pale yellow branches. Those of the dorsal pair of segments, three to eleven inclusive, are dull yellow, mottled with black, as is also the medium bunch of spines of the 12th segment, giving, when viewed without a lens, the appearance of a yellow dorsal line. There is a narrow central line of reddish brown, and each segment is also marked with transverse streaks of the same color, which, on the sides, become a broken but well defined band. Spiracles, orange, edged with reddish brown. Feet and legs also reddish brown, and segment tipped with the same color.

Length, 2.00 inches.

Food plant, Willows.

The above description is taken from one of several caterpillars, obtained in Fresno Co., Cal., by Dr. Eisen, and by him forwarded to Dr. H. Behr. In the description of the larvæ of *H. Maia Drury*, I find a notice of two reddish tubercles on each segment, which are entirely absent in the present species. In other respects they are much the same. *Maia* generally feed on oaks, while this was invariably found upon willows, and fed in confinement upon the weeping willow of the gardens.

Fam. NOCTUIDÆ.

Acronycta lepusculina. Grote.

Mature Larva. General color of body pale bluish green. Head a little paler. Mouth parts and prolegs deep black. Spiracles black, with whitish centre. The whole of the body is covered with very long silky white hairs, $\frac{3}{10}$ of an inch long, with some shorter black ones mingled, chiefly in the dorsal region. Abdominal legs bluish green.

Length, 1.10 inch.

Food plant, Poplars.

Changed to chrysalis July 23d; Imago, September 26th.

Drasteria erectho. Bdv.

Egg. Spherical, a little flattened at the poles; color, pale apple green, deeply striated, but with the striæ not reaching to the apex. Spaces between the striæ transversely rugged. Deposited separately on leaves of *Lupinus* and *Erodium*.

Fam. GEOMETRIDÆ.

Cidaria, 4-punctata. *Packard.*

Head and 2d segment, dull rose pink, the same color being continued broadly along the sides. In the lateral region are some small white dots. Dorsal region and underside, bright apple green, each segment tinged indistinctly with dull orange yellow. Feet and legs, dull rose pink.

Length, 1 inch.

Food plant, Fuschia; the stems of which plant are wonderfully mimicked in color by the caterpillar.

Chrysalis. Light brown, paler at the junction of the segments, each of which bears a transverse row of minute concolorous hairs.

Length, 0.60 inch.

Spins a very thin web on the underside of the leaf, which is slightly rolled at the edges.

Changed to chrysalis, June 25; Imago, August 4.

LIST OF SPECIES NOTICED IN THIS PAPER.

Papilio Philenor	Chrysalis.
Limenitis Californica	Larva and Chrysalis.
Lycæna antægon	Larva.
Deilephila daucus	Larva and Chrysalis.
Smerinthus opthalmicus	Egg and Carva.
Halesidota Edwardsii	Egg.
Spilosoma vestalis	Egg and stages of Larvæ.
Pseudohazis eglanterina	Egg and Larva.
Hemileuca Nevadensis	Larva.
Acronycta lepusculina	Larva.
Drasteria erectho	Egg.
Cidaria, 4-punctata	Larva and Chrysalis.

Dr. Henry Gibbons called attention to the frequency of earthquakes in different parts of the world during the present month.

The following propositions for membership were submitted:

W. H. Hall, J. P. Curtis, H. S. Craven, C. A. Stetefeldt, W. A. Skidmore, Howard Schuyler, Alfred Poett, James D. Hague, E. B. Dorsey, Hamilton Smith, Jr., Louis Janin, Charles Barton Hill, Joel F. Lightner.

On motion of Mr. Stearns, the Vice-President was authorised to appoint a committee of ten to confer with the Committee of the Art Association upon the subject of the obsequies of the late Benjamin Parke Avery.

The Committee appointed in the matter of sectionizing the

Academy, presented their report in the form of a preamble and resolutions, as follows:

To the California Academy of Sciences:

The Special Committee in the matter of Sectionizing the Academy, which was appointed at the last meeting, herewith present their Report, in the form of a Preamble and Resolutions, and respectfully request your favorable consideration.

WHEREAS, In many Scientific Societies, experience has proven that the objects for which such societies were founded and organized, namely, the advancement of Science and the diffusion of knowledge, have been promoted by the formation of sections for the pursuance of special studies and investigations, and as it is believed by many members that the formation of sections inside of the California Academy of Sciences will increase the usefulness of this Academy, and many of its members desire to form such sections, it is hereby

Resolved, That it is the sense of this Academy, that the objects for which it was founded will be advanced by the formation of sections, which may include such members as are pursuing special departments of scientific investigation and study, and as many members have expressed a desire to form sections in order to facilitate such investigations and studies, it is hereby provided that sections may be formed, and in the following manner, and under the restrictions herein contained.

Whenever not less than five members of the Academy shall unite to form a section, they shall have the right to do so, but shall first submit to the Council of the Academy, a written communication, signed by the members who propose to form such section, stating the department of science or the character of the investigation or study which it is intended the section shall pursue; but no section shall be considered as formed or be recognized by the Academy, until due notification thereof, which shall be made to the Academy by the President or the Recording Secretary, or in the absence of said officers, by some other member of the Council, at the first regular meeting of the Academy after or following the receipt of the communication from the members proposing to form such section.

And upon and after such notice at a regular meeting as above, such section shall be considered as established, and a written notice of the same shall be posted in a conspicuous place in the hall of the Academy, and the members of the latter shall have the right to attend the meetings of the section so formed. Persons not members of the Academy shall not be members of any section.

Sections formed as above, may make such by-laws as are deemed necessary, and the members thereof shall have the power to manage the affairs of the section to which they belong, and only the members of a section shall have the right to vote upon matters pertaining to the section to which they belong.

Provided, however, that no by-law or regulation made by any section shall conflict with the Constitution or By-Laws of the Academy.

If at any time it shall be found that the action of any section is detrimental

to the interests or objects of the Academy, or that any section through the apathy or dissensions of its members, shall cease to pursue or carry out the objects for which it was formed, or for any other good and sufficient cause, then the Academy may suspend or abolish such section by a two-thirds vote of the members present at any regular meeting, and any section so suspended or abolished shall not be continued or restored except upon the recommendation of the Council at a regular meeting of the Academy, and by a two-thirds vote of the members present.

Any and all property acquired by any section, shall be the property of the Academy, but may be segregated and kept apart from the general property of the Academy, for the special use of the members of the section to which it belongs, so long as such section may exist, but upon the dissolution or abolishment of any section, then the same shall be merged in the general property of the Academy.

A notice of the meeting of any section shall be posted in a conspicuous place in the Hall of the Academy, or announced at any regular meeting of the latter, but no meetings of any section shall be held during the hours or period of any meeting of the Academy, but at such other time as may be found convenient to the sections, and may be held in such rooms in the building of the Academy as may be available.

All of which is respectfully submitted,

ROBT. E. C. STEARNS,
A. KELLOGG,
WM. ASHBURNER,
HENRY EDWARDS,
Special Committee.

SAN FRANCISCO, January 7, 1876.

On motion of Mr. Scupham, the Report was adopted, and the Secretary instructed to spread the Preamble and Resolutions on the records, for future reference.

The Committee was continued, to aid in organizing the sections.

REGULAR MEETING, FEBRUARY 7th, 1876.

Second Vice-President in the Chair.

Twenty-one members present.

In the absence of the Secretary, W. J. Fisher was elected Secretary *pro tem.*

The following new members were elected:

C. L. Scudder, W. J. Graves, Samuel Purnell, Joseph Tilden, G. L. Lansing, Dr. R. K. Nuttall, Dr. J. T. Crook.

The following propositions for membership were submitted: S. Lubeck, life member; T. Bechtinger, resident member.

Donations to the Museum: Prof. Geo. Davidson presented the following: Rye from the Russian shores of the Baltic, plant and seed from Japan, cherry and apricot stones from Rome and Naples, Lupine seeds from Pompeii, Persian violet, cotton ball from Elephanta, Bombay, seed from India, *Casuarina* Equisiti folia (India), tree seed from Bombay, tobacco from the Nile, seed, orange seeds from Joppa, corn from the Nile (fourteen parcels in all), shell money, *cypræa moneta* (India), seven parcels of insects from India, Egypt and Italy, wheat from the valley of the Nile. From Henry Hemphill, the following Crustacea: *Cancer antennarius*, three specimens; *C. productus*, one; *Xantho spinituberculatus* (n. s.), one; *X. novemdentatus* (n. s.), one; *Xanthodes latimanus* (n. s.), one; *X. leucomanus* (n. s.), five; *X Hemphilliana* (n. s.), one; *Speocarcinus, Californiensis* (n. s.); *Randalia ornata; Lupa bellicosa; Acanthus spino-hirsutus* (n. s.); *Dermaturus Mandtii; Microrhynchus Hemphillii* (n. s.); *Inachus tuberculatus* (n. s.); *Fabia subquadrata*, two; *Pugettia Richii; Pisoides tumidus* (n. s.); *Pseudosquilla marmorata* (n. s.), one; *Alpheus equidactylus* (n. s.), one; *A. bellimanus* (n. s.), two; *Hippolyte palpator*, one; *H. cristata*, one; *H. Hemphillii* (n. s.), one; *Idotæa rectilinea* (n. s.), one; *Lambrus frons-acutis* (n. s.); *Scyra acutifrons; Crangon nigromaculatus* (n. s.), two; *Callianassa longimana*. From Henry Edwards, *Panulirus interruptus, Idotæa resecata, Hippolyte lineata, Acalephæ, Amblystoma, Sceloporus, Gasterosteus, Chiropsis guttatus, Orchestia Traskiana, Livoneca vulgaris*. From Mr. Curtis, through C. M. Kinne, *Ostracion*, sp? From the California Pioneers, one hundred and fifty specimens of ores and minerals. From Henry Edwards, precious garnet in mica slate. From W. N. Lockington, Sillimanite. From J. F. Jerome, minerals and ores. From Gov. S. Purdy, silver ore. From Holmes and Dawson, specimens of marble. From Prof. Davidson, *leucite* (white garnet). Ivory and palm nuts from the California Pioneers.

W. N. Lockington read the following description of twenty new species of Crustacea from California:

Remarks on the Crustacea of the Pacific Coast, with descriptions of some New Species.

BY W. N. LOCKINGTON.

Notwithstanding the small number of sheltered bays and coves to be found along the shores of the Pacific Ocean, south of Vancouver's Island, the Crustacea appear to be tolerably abundant, since the total number of species of the two highest orders, (the stalk-eyed and sessile-eyed) known or described up to this date, is about two hundred and twenty, and there is every reason to believe that a more searching investigation would at least double that number.

Neither Dana nor Stimpson did much work at the Crustacea south of San Francisco, and the species lately described by Smith are almost entirely from Panama. Between Panama and San Francisco lies a vast extent of coast, extending through nearly twenty-nine degrees of latitude, and embracing a region greatly diversified in climate and productions, so that although many San Franciscan species extend southward a considerable distance, and many Panama species may range along Central America, it is but reasonable to suppose that many undescribed forms have their limits between those extremes.

The reasonableness of this expectation will be rendered the more apparent by a glance at a map showing the ocean temperature. That portion of the ocean bathing the shores of California at San Francisco, belongs to the subtemperate oceanic zone included between the isothermal lines of 50° Faht. and 56° lowest cold, but the heat of the ocean increases rapidly as we travel southward, so that the coast from Monterey to San Diego, and for some distance south of the latter place, lies between the isothermal line of 56° extreme cold and that of 62°. The greater part of Lower California, with the Gulf, is included within the line of 62° extreme cold and that of 68°, and may be called warm temperate. From Cape St. Lucas to about the latitude of Acapulco is the sub-torrid zone, the isothermal line of 74° degrees lowest cold bounding it toward the south, and forming the northern limit of the torrid oceanic zone which extends to, or near to, Guayaquil, in the State of Ecuador.

Since Panama is situated close to the oceanic heat equator, it will be seen that in the 29° of latitude between San Francisco and that place there is a variation of about 30° in the lowest temperature of the ocean, a difference which must and does imply a corresponding variation in the animal life inhabiting the ocean.

It was, therefore, with great pleasure that I received, since our last meeting, a small but choice collection of Crustacea, collected at Monterey and San Diego, by Mr. Henry Hemphill, and my pleasure was still greater when I found, upon comparison with the specimens already in our museum, and with the writings of Stimpson and S. I. Smith, that this donation enriched us with at least 20 species new to science.

Up to this present time no species of Crustacea from Panama, and only one or two from the coast intervening between that point and San Diego,

have reached this Academy, and the amount of zoölogical riches yet remaining to be harvested in this quarter, may be guessed at from the fact that these twenty species were collected incidentally, as it were, the Crustacea not being the chosen field of the collector.

It is with some diffidence that I refer some of these species to their genera, simply because we have not in our collection specimens of many well known genera, nor have we in our defective library any figures or description of the already known species included in them.

To make clear to others the difficulty under which I and any other person who attempts to do a little original work in connection with this institution, are compelled to labor, I have but to state that two of the species described in this paper belong to a group of crabs, the *macropodidae* (distinguished by the great length and thinness of their legs), no species of which has before been known on this coast, but of which the typical forms are described and figured in such standard works as those of Milne Edwards, and Bell's British Stalk-eyed Crustacea, neither of which works are to be found in our library.

I have, therefore, in determining the genera, been compelled to be guided alone by the generic descriptions given by Dana in his Crustacea of U. S. Exploring Expedition, the only comprehensive work accessible to me, and that is lent to the Academy.

Before proceeding to the technical description of the new species, I wish to draw the attention of all members of the Academy at all interested in zoölogy, to a few peculiarities in our list of native Crustacea as it stands at present.

Two species of Macropodidae, as I have just said, are all that are yet known. The crabs of this tribe are sluggish in their habits and are usually found among sea weed, sponges and zoöphytes, at depths below those left bare at the lowest low tide, and are thus only obtained by dredging, unless cast ashore in some storm along with the sea weed among which they live. It is, therefore, almost a certainty that a properly organized search would disclose several other species, even in this immediate neighborhood.

Of the *Xanthidae*, a sub-family near the true *cancer*, not a single species has been described by Stimpson or Dana, and it is singular that among the newly found San Diego species this tribe predominates.

Only two species of the swimming crabs (*Portunidae*), have yet been found in California, one of these (*Lupa bellicosa*), has been described by Stimpson, and the other is new.

The parasitic Crustacea of various orders have not yet been collected with any thoroughness, but I may here mention that several, (so far as I am aware) undescribed forms have recently been added to our collection, and that I hope, during the course of this year, to be able to prepare another paper upon them and upon other undescribed species not included in the present paper.

Neither the Entomostraca, which include the *Cyclops*, *Cypris*, *Daphnis*, and many other tribes, nor the Barnacles or Cirripedia of this coast have yet been studied, and I trust that this short enumeration of a few of the things that want doing may stir up some of our members to do them.

The collection of Crustacea in this museum now includes about 320 species, almost all from this coast or from the islands of the Pacific. Scarcely any

European or Atlantic coast species, and none from South America, Austral or Africa, have yet reached us.

I have purposely made my technical descriptions short, giving only the salient characteristics which distinguish the species, but it is my hope to supplement these descriptions by a series of photographs of the new forms—a hope warranted by the present financially satisfactory state of this institution.

Inachus tuberculatus.

Rostrum, short, entire; pre-orbital spine marked only by the angle of the orbit; post-orbital spine slightly longer than the eyes; medial region of carapace with several small tubercles; posterior, with a large central tubercle surrounded by a ring of smaller tubercles; postero-lateral regions, with several small tubercles; all the regions prominent and separated by well marked depressions; three last joints of first pair of feet with scattered tubercles; manus stout; second pair of legs 2½ times the length of the post-rostral part of the carapace; sternum and abdomen with scattered tubercles.

Dimensions of two specimens:

	Length.	Width.	Length of 2d pair.
Male...............................	0.75	0.55	1.55
Female.......	0.56	0.38	0.94

Dredged in eight fathoms, upon a rocky bottom covered with weeds, at the mouth of San Diego Bay, by Henry Hemphill. This, and the following species, are the first examples of the *macropodidae* found on the California coast.

Microrhynchus Hemphillii.

Rostrum, short, entire; form of carapace, long and narrow triangular; post-orbital spine, small; antero-lateral margin marked by a line of hairs; 1st pair of legs short, the meros extending to the line of the eyes; 2d pair more than three times the length of the post-rostral part of carapace; 3d, 4th, and 5th pairs diminishing in length, the last a little less than twice the length of post-rostral part of carapace. A few scattered hairs on the two last joints of the four hinder pairs of legs, especially on the fourth joint.

A single male specimen of this species was dredged, in seven fathoms of water, in the Bay of San Diego. Length, 0.75; width, 0.33; length of 2d pair of legs almost two inches.

Pisoides? tumidus.

Rostrum, bifid, moderately long; no pre-orbital spine; post-orbital spine small; first joint of external antennae very wide, prolonged into a point externally. 1st and 2d pair of legs about equal in length; hand of first pair, stoutish; fingers gaping when closed, the ends toothed and fitting neatly together; a large tubercle on movable finger in the centre of the gaping part. Carapace, with the regions tumid and spineless, smooth and rounded behind. A single specimen, male, was found between tides, near San Diego. The whole of the carapace and feet are covered with a short pubescence, becoming

longer upon the margins of the limbs and forming a lamellate protuberance over the rostrum. Length, 0.65; width, 0.45; length of 2d pair of feet, 0.80.

Lambrus frons-acutis.

Carapace, transverse, somewhat pentagonal, each antero-lateral border having a rounded angle in the centre of its length; and the postero-lateral border forming an almost straight line with the posterior border. Rostrum, pointed, prominent, elevated, continuous with the elevated gastric region. A prominence at the cardiac region. Branchial regions prominent, each capped with a line of tubercles extending outward to the angle between antero and postero-lateral borders. Antero-lateral border finely toothed and terminating behind in an acute point. The portions of the carapace between the prominences are much depressed and perfectly smooth. Arm, carpus and hand of the first pair of legs, trigonal in section, each angle set with a continuous row of small tubercles. Dactylos turned inwards almost perpendicularly to the hand, very small. A single dried specimen brought from Santa Catalina. Length, 0.50; breadth, 0.70; breadth across arms when bent, 1.33 inch.

Xantho spini-tuberculatus.

Front four-lobed, areolets of anterior and antero-lateral portions of carapace prominent; six teeth on antero-lateral margin, including that of posterior angle of orbit; chelipeds covered with smooth shining tubercles on the upper portions, those of the hand arranged in seven longitudinal series; fourth and fifth joints of the four hinder pairs of limbs beset with spines on their superior portions.

Specimens from Santa Rosa, presented and collected by W. G. W. Harford.
Specimens from Monterey, presented and collected by J. G. Cooper.
Specimens from San Diego, presented and collected by Henry Hemphill.

Length of carapace of male,	0.44	width, 0.63
" " female,	0.38	" 0.57

Xanthodes latimanus.

Front sinuate, the inner angle of the orbit raised into a point; carapax but slightly transverse; teeth N. T. S., prominent and pointed, D and E almost obsolete. Areolation of medial and antero-lateral regions distinct, the former having the parts 2 M, and 3 M entirely outlined. Hands, sub-equal, the right somewhat the larger; movable fingers very long, and curved abruptly downward; margin of manus continuous with the broad base of the fixed finger so as to form a sinuous sloping line; hinder feet compressed. This species may be readily identified by the delicate marbling of the carapace and chelipeds, and the downward bend of the movable fingers. Abdomen of male, five jointed.

A single male specimen from San Diego. Length, 0.73; breadth, 0.88.

Xanthodes Hemphillii.

Front almost entire, slightly waved and somewhat produced; carapace, transverse, medial region prominently outlined; 1st antero-lateral tooth (D),

almost obsolete; 2d, (E), long and low; 3d, (N), 4th, (T) and 5th, (S), pyramidal and pointed; cardiac region faintly outlined. 1st pair of feet, subequal, smooth; hands without crests or tubercles; fingers, black. The movable finger of the right hand with a large tubercle at base; 3d, 4th and 5th joints of four posterior pairs of feet compressed, fingers villous.

A single male specimen found at Monterey. Length, 0.82; width, 1.10.

Xanthodes leucomanus.

This species appears to be very nearly allied to *X. Hemphillii*, having the front antero-lateral teeth, and areolation of that species. If there is any value in the subdivision *Xanthodes*, both should be included in it, as both have the first antennal joint connected with the front by a process. The principal difference between the two forms, size excepted, will be found in the network of raised lines upon the upper portions of the hand and carpus of the chelipeds in the present form; and the almost entire absence of the tomentosity upon the four hinder pair, which characterizes *X. Hemphillii*. The dactyli of the chelipeds are of a shining, leucous tint when recent. Several specimens, from Santa Rosa Island (W. G. W. Harford); Monterey (J. G. Cooper); and San Diego (Mr. Henry Hemphill). The carapax of the largest specimen measures half an inch in width, and 0.34 in length.

Xanthodes ? novem-dentatus.

Front rather narrow, prominent in centre, and produced forwards; teeth of antero-lateral margin, nine in number; carapace transverse; chelipeds long, the right considerably the larger; manus long and rather narrow, with a slight double crest on the superior margin; corpus with several blunt spines; posterior feet somewhat compressed, with a few scattered hairs on the margins.

A single male specimen, from San Diego. Total length, 0.94; breadth, 1.25.

Acanthus. Nov. gen.

This genus is proposed for the reception of a singular species found at San Diego by Mr. Henry Hemphill. Its characters are: front, two-lobed, with a deep central emargination; antero-lateral margin, front, and whole circumference of orbit surrounded by long spines; carapax, narrow; antero-lateral and postero-lateral margins about equal in length; body, thick; abdomen of male, seven jointed. This genus appears to be near Pilumnus, but I can detect no trace of a praelabial ridge.

Acanthus spino-hirsutus.

Besides the generic characters given above, this species may be distinguished by ten spines upon the front, pointing straight forward; a group of four on each side the central emargination, and a single spine close to the outer antenna, the second joint of which reaches nearly to its extremity; six or seven spines on lower margin of orbit, and four larger spines on antero-lateral margin of carapax, besides those on upper margin of orbit. Front portion of carapace and upper parts of all the feet thickly covered with

long stiff hairs, mixed, on the chelipeds only, with spines similar to those of the front of carapace. The whole upper surface of the carapax, the meros of the fifth pair of feet, and the posterior portion of the sternum are covered with a short and thick pubescence. Right hand considerably the larger; fingers of both hands with several large, blunt teeth or tubercles on their inner margin. The spines upon the hands change gradually to tubercles as they approach the fingers.

Length, one inch; breadth of carapace, 1.12.

Eucrate? Californiensis.

Surface of carapace smooth, very slightly granulate close to margins; antero-lateral margin three-toothed; carapace level transversely, but considerably curved longitudinally; abdomen of male five-jointed; right hand considerably larger than the left; hand broad and thin; laminate on superior margin; carpus with a spine on the interior distal margin; four hinder pairs of legs rounded, tarsi pointed.

The aspect of this species is exactly that of Stimpson's *Speocarcinus Carolinensis*, as figured in Notes on North American Crustacea, No. 1, but the abdomen is different.

Width, 1.06 inch; length, 0.82 inch.

The only specimen (dried) is from San Diego.

Pseudosquilla marmorata.

Carapace much narrowed in front, as in *Squilla*, but the body stiff and without carinæ upon the thoracic or abdominal segments, except upon the two last. Penultimate segment with two central spines flanked on each side by two lateral ones; a central carina, and five lateral ones on each side of the apical segment of abdomen. The central carina terminates in a spine, flanked just beneath by the two movable spines, counting from which, on each side are, 1st, a small blunt spine; 2d, a small acute spine; 3d, a large acute spine; 4th, a very small acute one; and 5th, a bluntish spine formed by the union of the two outermost carinæ of the last abdominal segment; the penult joint of the caudal appendages armed with nine spines, the last as long as the last joint of those appendages; first joint of caudal appendages prolonged backwards into a spine almost as long as the remaining two joints, and armed on its inner edge with two strong spines; antennary plate produced into an acicular spine, movable finger with two spines only on its interior edge; three movable spines at proximal end of manus.

The whole of the upper surface of this rare and beautiful crustacean is marbled, in its dry state, with yellowish brown spots on a dark brown ground, while the tips of the caudal appendages are a vivid red.

Length, from tip of rostrum to tip of movable spines, 3.80 inches; of carapace only, 0.82 inch; width of abdomen, 0.63 inch.

This single specimen in this collection was found at low tide, on sandy mud flats at San Diego.

This and *Squilla De-saussurei*, Stimpson, are, so far as I am aware, the only Stomapoda yet discovered on the shores of California.

Crangon nigromaculata.

Carapace with a single spine on the gastric region near the rostrum, and a larger spine on each hepatic region. Suborbital and antennal spines present. Inner antennæ about equal in length to movable scale of outer antennæ, and the base of outer antennæ about half as long as its movable scale; Dactylos of first pair of feet transverse, short; an oval black spot on each side of the abdomen just anterior to the caudal processes.

Three specimens from San Diego, dredged in six fathoms of water.

Total length of largest specimen from tip of antennal scale to tip of tail, $2\frac{1}{4}$ inches; of body from tip of rostrum, 2.06 inches.

This species can readily be distinguished from all others by the black spot upon each side of the tail; it appears to be nearly allied to *C. nigricauda*.—Stimpson.

Crangon Alaskensis.

Rostrum very short and pointed; spines of carapace, as in *nigromaculata:* inner antennæ scarcely as long as movable scale of outer antennæ; movable finger of first pair of legs rather long, oblique; hands, carapace, and abdomen in preserved specimens (alcoholic), clothed with minute black spots.

This species may be distinguished from *C. nigricauda*, which it much resembles, by the greater obliquity of the palm of the hand, the different coloration, and the smaller size.

Length of body, 1.45 inches.

Several specimens from Mutiny Bay, Alaska, presented by the U. S. Coast Survey.

Alpheus bellimanus.

At the time of the publication of Stimpson's Crustacea and Echinodermata of the Pacific Shores, no species of *Alphæus* had been detected in California, but recently two species have been collected by Mr. Henry Hemphill, of San Diego. The present species may be easily recognized by the beautiful coloring of its hands, which, in a dried specimen, are orange, with various spots and workings of black and white.

Movable finger of larger hand small, depressed, and closing in a plane oblique to that of the manus, which is furnished with a spine on its outer edge, and a second beneath, has a toothed margin opposed to that of the dactylos, and presents two longitudinal grooves on its under surface, the anterior groove terminating in a transverse depression; in the smaller hand the dactylos is laminate and in the same plane with the hand, which has an exterior spine like that of larger hand, and another on its inferior surface. The fixed finger of the larger hand is longitudinal, and has an almost straight edge; the annulations of the carpus of second pair are only four in number; there is no tooth on the lower apex of the third joint of the third and fourth pairs of legs.

Two specimens from San Diego, found among kelp.

Length of larger specimen, from joint of rostrum to end of abdomen, 1.20 inches; length of larger hand, half an inch, of smaller, 0.38.

The carapace presents traces of a similar coloration to that of the hands.

Alpheus equidactylus.

A single dried specimen, broken, from Monterey, is all that we possess of this very distinct species. The larger hand has a transverse sulcus immediately posterior to the finger, and the movable and fixed fingers are of equal length and extended in the same place with the hand. The rostrum is narrow and sharp.

Length, 0.75 inch. The fingers of the chelae shut close together when the hand is closed.

Betæus longidactylus.

Form much more compressed than in *alpheus bellimanus;* hands similar in form; long and compressed; the fixed finger half the length of the hand, the movable one more than half that length; the fingers when closed gape widely; both are pointed at the end, and the points cross each other like the mandibles of a *Loxia*. At the origin of the movable finger are several teeth, opposed to two large ones upon the hand itself, which also bears a large tooth in the centre of the length of the fixed finger.

Color of carapace of dried specimen, green, with nuances of russet and olive. The fingers of the larger hand are light red, the tips green.

Length of carapace, 1.12 inch; of larger hand, 0.56 inch; of smaller, 0.36 in.

A single specimen from San Diego, on a sandy mud flat, between tides.

Hippolyte? Hemphillii.

I give this provisional name to a single specimen (dried), brought from San Diego by Henry Hemphill. Several of the feet are wanting, and the specimen is distorted so as to render a detailed description impossible. The rostrum is short and has four teeth, besides the long terminal tooth. The limbs are handed transversely with alternate dark and light tints.

Length, 1 inch.

Hippolyte lineata.

Rostrum less than half the length of the carapace, armed with seven teeth on the upper side (including the terminal one), and three on the lower; the two hinder teeth only are on the carapace, and are longer, but not higher than the others; outer maxillipeds reaching to the tip of the movable scale of outer antennæ; hands of first pair small and slender. The most noticeable characteristic of this species is the presence of eight longitudinal lines of a tint lighter than the ground color of the body. Upon the carapace these eight lines become broken up, and mingled with other markings, producing a pattern resembling that of watered silk. Two dried specimens from San Diego, collected between tides, and one larger one, in alcohol, presented by Henry Edwards.

Length of largest specimen, from tip of rostrum to end of abdomen, 2¼ inches.

Idotœa rectilinea.

Body, slender; not increasing in width backwards; all the segments of the thorax equal in width, and the abdomen rectilinear, nearly as wide as the thorax; first two segments of abdomen, distinct; total length of abdomen about equal to that of last three thoracic segments; posterior extremity obtusely pointed. Thoracic segments equal in length. Outer antennae, long; the peduncle equal in length to the three first segments of body; flagellum broken in both specimens. Color, various; one dried specimen almost entirely black, the other with a black line down centre of body, the rest of which is yellowish.

Length, 0.80 inch. Width, 0.17 inch. San Diego.

Serolis carinatus.

Thorax and abdomen conspicuously keeled upon the centre of every segment; the first segment slightly waved on its posterior margin, the curve of the segments increasing rapidly, in such a manner that the last entirely encloses the free abdominal segments on their sides. Caudal segment rounded at the extremity, with two marginal teeth on each side, at a considerable distance from the extremity, the central carina running the entire length of the segment; last basal joint of inner antennæ longer than the flagellum; flagellum of outer antennæ much shorter than either of the two of the preceding basal joints, and last basal joint about equal in length to the penultimate. Eyes large, reniform, conspicuous. The texture of the upper surface of a dried specimen, under a two-thirds power, has a somewhat squamate appearance. Color, a grayish brown, diversified with dots and irregular markings of black; hands long and slender; dactylos equal in length to the manus.

Two specimens from San Diego. Length, 0.21 inches; width, 0.16 inches.

T. A. Blake read portions of a petition to Congress, from the Boston Society of Civil Engineers, relating to the adoption of the Metric system of weights and measures.

On motion, the Chair was requested to appoint a committee in regard to the memorial.

The Vice-President informed the Academy that Dr. Gerhard Rohlfs had kindly consented to lecture before the Academy upon his travels in Africa during the years 1860 and 1867; the lecture to be delivered the Monday following this announcement.

On motion of Dr. Stout, Dr. Rohlfs was invited to become the guest of the Academy during his stay in San Francisco.

The judges of election reported having duly filed the certificate of election with the County Clerk.

REGULAR MEETING, FEBRUARY 21, 1876.

In the absence of the President and Vice-Presidents, Dr. Henry Gibbons was called to the Chair.

Nineteen members present.

Chas. F. Dio Hastings was proposed as a life member.

Donations to Museum: J. G. Lemmon of Sierra Valley presented twenty-five specimens of plants. T. J. Butler, of Arizona, presented a number of minerals. From Henry Edwards specimen of *Chiropsis nebulosus*. From Mr. Harford, *Clypidella Callomarginata* and parasite worm on *Glyphis aspera*. Ascidian from Santa Rosa Island, *Vermes* from Santa Rosa Island, common under stones. From Mr. Baldwin, *Lysiosquilla*. From Gen. Cobb, *Pelecanus erythrorhynchus*.

On the first of March, 1875, at the regular meeting of the Academy, a box of minerals from Australia was presented by Mr. E. O. McDevitt, through Gen. John Hewston, Jr. Having no place to put them, the box was not opened until recently, and was found to contain forty-eight specimens of minerals, seven teen fossils, six photographs, and a map of the tin fields of Queensland—all of which were exhibited. Eleven of these specimens are gold-bearing, three of lead ores, eight of copper ores, two of cinnabar in quartz associated with blue and green carbonates of copper disseminated through the quartz—these two are handsome specimens; there are none like them in the museum; two of antimony ores, specimens of Herschelite (a variety of Gmelinite), bismutite (a carbonate of bismuth), drift in which diamonds are found; a very interesting series of specimens from the tin fields, comprising tin crystals in quartz, wash dirt in which tin is found, stream tin, pebbles from tin washings, a smoky quartz crystal from the tin washings tourmaline (or schoolsand, being worn grains called by the miners sham tin), titaniferous iron sand (also called sham tin), bed rock of lode tin with tin crystals, and metallic

tin from the Queensland Tin Smelting works. There are also coal, chromic iron, granite, marble and other specimens. There are seventeen fossils, nine of which are fossil shells, two of fossil wood, one of the teredo in fossil wood, and shales from the coal mines containing impressions of leaves and ferns. Two photographs are of mummies, and four of birds, with their nests.

From J. G. Lemmon, *Botrychium ternatum*, *Marselia vestita*, *Glossopetalon Nevadensis*, *Darlingtonia Californica*, *Ivesia Pickeringii*, *Ivesia Gordoni*, *Ivesia unguiculata*, *Cyclademia humilus*, *Ranunculus Lemmoni*, *Astragalus Lemmoni*, *A. pulsifera*, *Webberi*, *Polemonium humile* (var.), *Eriogonum ursinum*, *Astragalus Casei* (new species), *Eriogonum*, *Blitum carinatum*, *Gentiana Newberyi*, *Horkelia* (sp.), *Ivesia Webberi*, *Ranunculus oxynotus*, *Viola Lemmoni*, *Corydalis Caseana*, *Draba aurea*, *Sanicula Nevadensis*, *Antennaria microcephalum*, *Hulsea cecaule*, *Scutellaria nana*, *Emmenanthus pusillus*, *Phoradendron librocedri*, *Glyptopleura marginata*, *Leucothœ Davisœ*, *Phacelia procera*, *Parnassia parviflora*, *Acerates atropurpurea*, *Cynoglossum occidentalis*, *Cuphosbia* (new species), *Platyspermum scapigernum*, *Potentilla Pattensis*.

Dr. Kellogg made some remarks on a plant presented.

Mr. Scupham asked for information on a plant which had the property of coagulating milk, like rennet.

Dr. Behr stated that the plant from which quassia comes has this property.

Dr. Gibbons said that *Gratiola Virginica* also had the property. Medical writers state that quassia is one of the best bitters known. He also spoke of the peculiarities of certain plants which were harmless to man and injurious to animals, and *vice versa*. He spoke of plants injurious to fleas, stating that the impression that the Yerba Buena leaves would drive away fleas was incorrect. The powder of Artemesia filifolia is fatal to fleas.

A discussion ensued concerning the poison oak, and the liability of some persons being poisoned while others escaped its evil effects.

Regular Meeting, March 6th, 1876.

President in the Chair.

Thirty-eight members present.

The following new members were elected:

Louis Janin, James D. Hague, H. S. Craven, C. A. Stetefeldt, C. W. Lightner, E. B. Dorsey, W. A. Skidmore, Howard Schuyler, Hamilton Smith, Jr., Alfred Poett, W. H. Hall, J. S. Curtis, Chas. Barton Hill

Dr. Stout, Curator of Ethnology, called the attention of the Academy to the peculiar sarcophagus in which the remains of the late Benjamin P. Avery had been brought from China. As there was a likelihood that this sarcophagus might come into the possession of the Academy, Dr. Stout wished a resolution passed authorizing the Curator of Ethnology to receive it.

On motion, Dr. Stout was appointed a Committee of one to receive the sarcophagus for the collection.

The President exhibited specimens of boomerangs, such as were used by the California Indians. They were in general similar to those used in Australia, though some minor points of difference are noticeable.

The President stated that he proposed to present verbally to the Academy some of the results of the experience gained during his recent trip of eighteen months duration. His travels had extended to Japan, India, Egypt, and parts of Europe, the principal object being the gathering of information with regard to the different late improvements in civil engineering in general, but more especially in the departments of River and Harbor improvements, and irrigation. He then made a short general statement regarding his trip.

A letter was read from Sir Edward Thornton with reference to the Albert Medal which is awarded annually by the society for the encouragement of arts, for distinguished merit in promoting arts, sciences and manufactures. Suggestions are invited from the Academy.

The resignation of W. J. Fisher as Librarian was tendered and referred to the Council.

On motion of Dr. Stout, a vote of welcome was passed "to our returned President."

General Colton, of the Board of Trustees, stated that a letter had been received by the Board from the Central Pacific Railroad Company asking the use of certain ethnological specimens for exhibition with their collection at the Centennial. Mr. Scupham, a member of the Academy, would have personal charge of the Railroad Company's collection, and would take equal care of the objects loaned by the Society. He moved that the articles be loaned for the purpose specified.

Mr. Scupham explained that it was intended to make as full a display as possible of Pacific Coast material, and the co-operation of the Academy would be of assistance—the Company's collection of ethnological specimens being meagre.

The motion to lend the articles asked for was then put and passed.

Regular Meeting, March 20th, 1876.

The President and Vice-Presidents being absent, Dr. Harkness was called to the Chair.

Forty members present.

Chas. F. Dio Hastings was elected a member.

J. K. Nelson was proposed as a candidate.

Donations to the Museum: From F. A. Walley, chloritic slate, Sonoma Co. From Governor Purdy, silver ore from *De Leon* mine, Sonora, Mexico, and gold quartz from Calaveras County. From Dr. J. M. Hill, quartz from Calaveras County, Cal. From Geo. H. Saunders, specimens of mineral resin, hematite (red ochre), larva and petrified wood. C. C. Bean presented silver ore from Peek Mine, Arizona. T. J. Butler donated specimens of calcareous tufa, argentiferous galena from Arizona.

The Secretary read a communication from the President, giving data concerning the solar eclipse of March 25th, 1876.

W. N. Lockington presented a second paper "On the Crustacea of California," containing a description of seventeen new species.

Description of Seventeen New Species of Crustacea.

BY W. N. LOCKINGTON.

Platypes, nov. gen.

Rostrum simple, post and pre-orbital spines wanting, hinder feet laminate.

Platypes edentata. nov. sp.

Rostrum laminate, triangular, simple; carapace tuberculate, the tubercles not prominent, and each covered with smaller tubercles.

Form of carapace broad, pyriform; antero-lateral margin not well defined, indistinctly lobed; postero-lateral and posterior margins forming a continuous curve, without spines or projections. Eyes not projecting, rostrum and antero-lateral margin forming a continuous line.

Propodus of first pair smooth, oblong; fixed finger and dactylos closing only at the tips, which are somewhat spoon-shaped, manus with an alveolate upper edge. Hinder four pairs broadly laminate.

Length of largest specimen, a female, 0.44, greatest width, 0.38.

Three specimens of this small and curious species from Mazatlan, presented by Hy. Edwards. Not having seen anything similar, or met with any generic description which seems to apply in every respect, I propose to make it the type of a new genus.

Atergatis cristatissimo.

Carapace transverse, elliptic, the front and antero-lateral border forming the greater portion of an ellipse, the front not projecting beyond the line of the ellipse. Antero-lateral margin cristate, the crest divided by short sulci into four lobes, of which the 2d is short, the 1st and 3d long, and the 4th turns somewhat abruptly inwards, the crest ending half way along the postero-lateral border, which is short and only slightly concave. Front slightly waved. Areolation distinct upon the central and antero-lateral regions, but becoming obsolete posteriorly.

Chelipeds about equal in size, manus with three distinct low beaded ridges on the outer side, and a sharp crista above, the latter continued along the carpus. Fixed finger short, with a long sharp tooth on its inner face. Dactylos cristate above, inserted some distance below the upper margin of the manus. The fingers are pointed at the ends, and knife-like on their inner edges. Hinder limbs cristate, compressed, claws long and sharp. Color

(dried specimens) a bright vermillion red throughout, except the fingers, which are brown.

Length, 0.50; width, 0.70.

The specimens are from La Paz, Lower California, and were collected and presented by Dr. D. E. Hungerford.

Xantho multidentatus.

Areolets of anterior part of carapax distinct. 1 M confluent with 2 M, which is partially cleft by a furrow; all the antero-lateral areolets (1, 2, 3, 4, 5, 6 L) distinct; also, the postero-lateral (1, 2 and 3 R) and posterior (1, 2 P) sufficiently distinct to be made out.

The projecting lateral teeth are the normal ones, D being simple, E and T double, N and S triple. The upper margin of the eye is enclosed in a semicircle of teeth, the outer of which is the first of the antero-lateral series. Two teeth intervene between the outer tooth and the front, which is four-toothed, and deeply emarginate in the centre.

Upper parts of hand and carpus covered with sub-seriate tuberculations. Posterior feet short, compressed, cristate.

The single dried specimen, a male, shows traces of a dark purple tint on the carapax and anterior feet.

It was collected at Mazatlan, by Mr. Hy. Edwards.

Acteodes Mexicanus.

Carapax smooth, unarmed, transverse, wide, antero-lateral border forming, with the front, the greater part of an ellipse. Teeth of antero-lateral border reduced to slight curves. Front somewhat waved, and slightly projecting beyond the general curve of the ellipse.

Areolets indistinct throughout, yet the median can be distinguished from the antero-lateral. The sulcus between the gastric and cardiac is well-defined, and most of the sub-regions can be made out. Postero-lateral border only slightly concave, forming a very obtuse angle with the posterior border.

Right cheliped the larger, entirely unarmed, smooth; fixed finger with two large tubercles on the inner face, dactylos with two large and two small tubercles; the fingers not spoon-shaped, gaping, and touching at the points only. Left cheliped smaller, and differing from the right in the fingers, which fit pretty closely throughout their length, tips spoon-shaped.

Hinder limbs smooth, weak, slightly heavy in the last two joints.

A single male specimen from Mazatlan, collected and presented by Mr. Hy. Edwards.

Length, 0.56. Width, 0.80.

The general color of the dried specimen is a dull reddish brown, inclining to red on the under side of the chelipeds. Fingers dark brown.

As the fingers of the smaller hand are distinctly spoon-shaped, I have called this an *Acteodes*, but it is evidently a connecting link between that genus and *Actæa*.

Amphitrite Edwardsii.

Inter-antennal front four-toothed, the teeth rounded, and the central emargination by far the deepest. A deep sinus between the front and the pre-orbital tooth, which is two-lobed; thus there are altogether eight teeth between the eyes. Antero-lateral margin nine-toothed, the teeth alternately large and small, commencing with a post-orbital. Meros of left cheliped (the right is wanting in our specimen) with four teeth on the inner margin, the tooth next carpus much smaller than the others. Carpus with a long spine on the inside, and four spines on the outside. Manus with three spines above, and three rows of small tubercles on the outside. Fingers sulcate, tuberculate on inner border. Two transverse ridges across the carapax, one in the center of the length, divided into three portions by the sulci separating the central region from the antero-lateral ones; the other shorter, crossing the central region in its widest portion. These ridges are beaded.

Length, 0.87. Width, 1.25.

The specimen is a male, and was brought from Mazatlan by Mr. Hy. Edwards. This, and *Lupa bellicosa* Sloat, are the only Portunidæ yet known on the Pacific Coast north of Central America.

Betæus equimanus. n. s.

Base of inner antennæ three-fourths the length of base of outer antennæ, flagella about half as long as those of the external antennæ. Outer appendage of inner antennæ about two-thirds as long as the inner. External antennæ considerably more than half as long as in the body. Outer maxillipeds as long as base of inner antennæ. Hands of first pair of legs about equal in size, oblong ovate; dactylos with a sharp recurved point, and a straight cutting edge margined with setæ; the cutting edge is opposed to a similar straight cutting edge, also margined with setæ, on the palmar surface, which also ends in a sharp incurved point. The fingers gape somewhat at the proximal end, where they are tuberculate. Second pair of feet slenderer than the third and fourth; but not much longer.

Front curvately emarginate between the eyes, which are clearly visible through the projecting part of the carapace. Carapace recurved. Body considerably depressed. Epimera (Coxæ) of second abdominal segment large, overlapping those of the adjoining segments.

Length of larger specimen, 1.05.

Two specimens, both females with ova, which in one case are large and evidently mature.

This species lives under the mantle of *Haliotis rufescens*, and the specimens were procured at Catalina Island by S A. L. Brannan. Color in alcohol, a light flesh color, the liquor itself taking the same tint; when fresh, a dark purple.

Alpheus clamator.

Front tri-spinose, the largest point forming the rostrum, and slenderer than the others, from which it is separated by a deep sulcus; the lateral spines quickly widening out into a shield curved closely over the eye. Carapace

smooth, body not greatly compressed. Epimera of second segment overlapping those of preceding and succeeding segments.

Flagella of inner antennæ about half as long as body, those of outer antennæ more than three-quarters as long as body.

Hands of first pair of legs dissimilar both in size and form. Fingers of smaller pair straight, parallel and slender, closely fitting; the manus with a spine above, and a constriction posterior to the insertion of the dactylos. Manus of larger or right hand large, with a large spine on the outer side, continued as a carina for a considerable distance backwards, and with a deep sulcus above the carina. Dactylos short, curved obliquely downwards, thick and swollen at the extremity. A deep transverse sulcus between the dactylos and manus, ending in an oblique longitudinal sulcus having its origin on the upper edge of the manus; from the latter sulcus a second transverse one is continued down the inner side of the manus.

Both hands setose, the hairs long and numerous.

Carpus of second pair five-jointed, third and fourth joints shortest, the manus and dactylos slender.

Length, 1.05.

Color, in alcohol, a light flesh tint, much deeper on the large hand. A darker spot on the upper surface of the carapax, also on the anterior edge of the two first abdominal segments.

This species lives in pools on rocky reefs at low-tide level, and is capable of producing, by clapping together the fingers of the larger hand, a snapping noise like that which can be made with the finger-nail.

Collected at Santa Barbara Island by S. A. L. Brannan.

Idotæa pulchra.

Body stiffly articulated. Cephalic shield emarginate in centre of front forming two lobes.

First thoracic segment concave in front, advancing around the head; first four thoracic segments sub-equal in length; 3d and 4th about equal in width; three hinder thoracic segments much shorter. Abdomen one-jointed, one short partial suture on each margin near thorax, tapering to posterior extremity, which is narrow, but concave. Margins of all the thoracic segments deflected outwards horizontally.

Flagellum of outer antennæ not quite as long as base, 16-jointed, base somewhat setose. Inner antennæ very short.

Length 1.15 in , breadth 0.52 in.

When recent, the coloration of this species is very beautiful, consisting of red cloudings on a lighter ground.

The two specimens, male and female, in this collection were brought from the W. coast of Alaska, N. of Bhering's Strait, by W. J. Fisher, Naturalist of the U. S. S. *Tuscarora*, Deep-Sea Sounding Expedition.

Idotæga. nov. gen.

Last pair of abdominal appendages operculiform, and concealing all the preceding pairs, as in *Idotæa*, but with four posterior pairs of legs, with

small claws, and the three anterior pairs sub-dactyle, as in *Pterelas* in the family *Ægidæ*.

Idotæga longicauda.

Thorax increasing in width to the central segment, length of segments nearly equal, the posterior slightly shorter. Cephalic shield deeply emarginated at sides, each border forming two blunt teeth. Epimera large, pointed, extending behind their respective segments, the backward curvature increasing with each successive segment. Abdomen at origin as wide as thorax, first three segments pointed on each side, the point directed backwards; fourth segment narrower and shorter than the others, and enclosed laterally by the third; terminal segment very long, more than one-third the total length of animal, and gradually diminishing to a truncate point.

Eyes remote, inconspicuous. Flagellum of external antennæ nine-jointed. First joint very long, flagellum about equal in length to base, which is hirsute on interior margin. Internal antennæ reaching to near middle of ultimate basal joint of outer antennæ. First three pairs of legs sub-didactyle, with a short hatchet-shaped process on the joint preceding the manus, which is broad and margined with short hairs on palmar border. Four posterior pairs of legs with short stiff hairs on the upper margin of 3d, 4th, and 5th joints.

Two specimens showing a slight difference in the form of the caudal segment, which in the smaller specimen has an obtuse angle on each lateral margin, at about one-third of its length from the extremity.

Length of large specimen, 2.80 in.; greatest breadth across epimera, 1.00 in.

Length of smaller specimen, 1.80 in ; greatest breadth, 0.66.

The larger one was found by Capt. T. W. Williams, in lat. 67.30 N., long. 163.02 W., near the coast of Alaska. The smaller specimen was found by J. W. Fisher.

The larger is a skeleton only, the smaller, a male, in alcohol.

This species is totally distinct from any yet found on the Pacific Coast, but, since it occurs so far to the north, it is possible that it may be identical with some previously described species from the Arctic waters of the northeast of America.

Sphæroma olivacea.

Cephalic shield curved anteriorly, distinct from the first thoracic segment, which is but slightly longer than either of the succeeding four segments; last two thoracic segments very short. Abdomen with two distinct joints, the first marked with two partial sutures; the hinder segment curved posteriorly; caudal process not reaching beyond the caudal segment.

Length, ⅓ of an inch.

This species is exceedingly common in the lagoons of the salt-marshes at Fort Point, San Francisco, where it resides among weeds, or adhering to the underside of sticks, etc.

The chief distinctions between this species and *S. Oregonensis* as figured by Dana, are the more projecting cephalic segment, and the small size of the two hinder thoracic segments.

Æga Harfordii.

Sides of thorax almost straight, segments sub-equal. Cephalic shield rounded in front, eyes conspicuous, situated at the postero-lateral angle of shield. Abdominal segments five or four, last segment pointed. Exterior antennæ more than half the length of body, flagellum more than twice the length of base, many-jointed.

Epimera of all the thoracic segments except the three first, pointed behind, and extending further back than the segment to which they are attached. Claws of first three pairs of legs comparatively feeble.

Length, 0.63 in.

Collected at Santa Rosa Island by W. G. W. Harford, under stones at mid-tide in muddy places. Numerous.

Æga alaskensis.

Body broadest at 5th thoracic segment, sides regularly curved, 5th and 6th thoracic segments greatly larger than first four thoracic segments, 7th segment longer than 4th.

Head pointed in fronted, the sides continuing the curve of the thoracic segments. Epimera of 4th segment pointed posteriorly, as are also those of 5th, 6th and 7th thoracic segments.

First four segments of abdomen concave posteriorly, and ending laterally in a point directed backwards; 5th segment with a straight posterior margin, pointed at sides; terminal segment a half oval.

Eyes large, conspicuous, not projecting. Antennæ short, the outer reaching to the suture between 1st and 2d thoracic segments; flagellum about equal in length to base. Last four pairs of legs somewhat spinose.

Color (in alcohol) 4th, 5th, 6th and 7th thoracic segments dark brown, a little dark brown on posterior part of 4th and 5th abdominal segments, rest of body yellowish; egg-case dark brown.

Three specimens, all females, taken from codfish caught in Ounimak Pass, Alaska, lat. 54° 40′, long. 165°, by Capt. T. W. Williams.

Length of largest specimen, 1.30 inch; greatest breadth, 0.48 inch.

Lygia septentrionalis.

Two posterior thoracic segments much shorter than the anterior ones, and greatly curved. Caudal stylets short, about half as long as abdomen.

Outer antennæ about half as long as body, flagellum with twelve somewhat oblong joints, somewhat shorter than base. Cephalic shield with a waved, somewhat two-lobed posterior margin.

Length, without caudal stylets, 0.80 in. Width, 0.45.

The sides, from the second to the sixth thoracic segment, are almost parallel. Two specimens from Tanaga, one of the Aleutian Islands, presented by Mr. W. J. Fisher, naturalist of the U. S. Exploring Ship *Tuscarora*.

The general facies of this species is very like *L. occidentalis*, but it is easily distinguished by its short posterior stylets.

Caprella tuberculata.

Inner antennæ long with a fringe of long setæ on their underside; second, third and fourth joints about equal in length. Outer antennæ without setæ, almost as long again as inner ones: flagellum somewhat larger than the two last basal joints; second basal joint larger than the preceding or succeeding ones; the entire base not quite as long as inner antennæ.

Propodus of 1st and 2d pairs oblong ovate, without teeth or spines, dactylos long and slender, fitting close to palmar surface. Manus of second pair spinose at extremity. Branchiæ short and thick.

2d, 3d, 4th and 5th segments long, sub-equal, the 1st segment somewhat shorter, the 6th and 7th very short. The whole of the dorsal surface sparsely covered with small sub-spinose tubercles.

Length of a large female, 0.90; ditto, from extremity of larger antennæ to top of posterior dactyli, 1.75; of outer antennæ, 0.56; of inner, 0.30 in.

Several specimens, chiefly females, were brought from Icy Cape by Mr. W. J. Fisher, who procured them by dredging, at a depth of from seven to fifteen fathoms.

Megalorchestia franciscana.

Body smooth; superior antennæ one-third longer than the body, the flagellum longer than the base, with about thirty-five oblong joints. Superior antennæ reaching to middle of 2d joint of inferior. Second epimerals longer than deep, fifth short, bi-lobed. Anterior feet unguiculate, joints scabrous. Hand of second pair very large, oblong ovate, with an almost transverse palm, having a low oblong tooth near centre of palm. Dactylus much curved, touching palm at point only when closed.

Length of body, 0.87; of inferior antennæ, 1.15 inch.

A single specimen of this species was found by myself among the debris at high-tide level, Alameda Co., Cal.

The antennæ in the recent specimen were red.

This amphipod resembles *O. scabripes*, Dana, but differs from the figure of that species in Dana's work in the greater number of joints of the inferior antennæ, the shape of the tooth of the hand, and the proportion of the second epimerals. From *M. Californiana*, Brandt, it differs in the short fifth epimeral, and the scabrosity of the feet.

Œdicerus Behringiensis.

Cephalic shield rostrate, the rostrum about one-third the length of superior antennæ, curved downward, pointed. Eyes moderately large, contiguous. First six thoracic segments much shorter, with a slightly raised keel in the centre of each. Seventh and abdominal segments long, the seventh thoracic and two first abdominal with the carina divided into two sub-equal teeth, the third abdominal with a long low carina ending in a spine posteriorly.

Fourth epimeral much longer than the fifth. Superior antennæ about three-fourths the length of the inferior; flagellum twice the length of last basal joint. Inferior antennæ about one-third as long as the body, proportions like those of superior. Hands of first two pairs of feet oblong ovate, palms nearly

straight, dactyli long, fitting close. Seventh pair of feet larger than the others, but not extending much beyond the end of the caudal stylets, which are nude.

Length from end of rostrum to end of caudal stylets, 1.25 in.

Four specimens from West coast of Alaska, North of Behring's Straits.

Presented by the Alaska Commercial Company.

Lysianassa Fisheri.

Segments of thorax about equal in length, smooth; third segment of pleon one-fourth longer than the second, with a well-defined sinus on the posterior margin, bounded by a sharp tooth below.

First epimera larger than two succeeding pairs, and extending forwards at their lower portion; fourth epimera largest. First joints of superior antennæ very stout, touching each other, so as to appear a prolongation of the cephalon; second joint very short and stout.

Length, including stylets, 1.38 in.

A single specimen of the above species was obtained on the West coast of Alaska, and presented to this museum by W. J. Fisher.

As the specimen is unique, and dried in such a way that the four first pairs of feet are folded together within the epimera, it is impossible to describe them.

Mr. Gruber read the first of a series of popular papers on Ornithology, illustrating his remarks with appropriate specimens prepared by himself.

Regular Meeting, April 3d, 1876.

President in the Chair.

The following propositions for membership were received:

Albert Arents, C. A. Lockhardt, Louis Falkenau, H. W. Reese, Emlen Painter.

Donations to the Museum: From C. B. Turrill, specimens of *Batrachoceps attenuatus*, *Gerrhonotus*, *Actinemys marmoratus*, *Plestiodon*, sp., *Bufo Columbiensis*, trout from Donner Lake, *Bryttus*, Myriapods, *Arachnidæ*. From Henry Edwards, specimens of *Diemyctylus torosa*, twenty-seven specimens of *Myriapoda*, and sp. of *Pseudobdella*. From W. N. Lockington, specimens of *Asterias*

From A. W. Saxe, borings from artesian well at Santa Clara. From Capt. Thos. W. Williams of whale ship Florence, eyes of the *Balœna Mysticetus* and *B. Sibbaldius*. From F. Gruber, specimens of barred owl (*Syrnium nebuloseum*) mottled owl (*Scops Asio*), and Carracara eagle (*Polyborus thaurus*). From Henry Edwards, *Dyadophis mirabilis*. From Col. Geo. E. Gray the following mollusca, *Anodonta Californiensis*, *Physa humerosa*, *Tyronia Clathrata* (Stmp.), and *T. protea*. From Henry Hemphill, specimens of new species of brackish water mollusk, *Paludinella Newcombiana*, with descriptions. Also *Alexia setifer* from Eureka, H. B., a shell forma also on China, but possibly introduced on this Coast by the Chinese.

Description of a New California Mollusk.

BY HENRY HEMPHILL.

Paludinella Newcombiana. Hemphill.

Shell thin, turbinate with four or five rounded whorls; apex sub-acute, last whorl somewhat inflated, subrimate, with or without three or four longitudinal brown bands; aperture ovate, outer lip thin, inner lip appressed to the columella and somewhat thickened; suture deep; epidermis greenish.

Operculum with nucleus sub-central with 2½ whorls.

Length of largest specimen, ⅜ inch.

Breadth of largest specimen, $\frac{3}{16}$ inch.

Habitat, Humboldt Bay, California.

I found this shell quite abundant on the Salt Marshes surrounding Humboldt Bay, California, associated with *Alexia setifer Coop.*, and *Assiminea Californica Coop.*, both of which are also abundant.

I take great pleasure in naming this species after my old friend Dr. W. Newcomb, well-known to the Scientific world, to whom I am much indebted for aid in my conchological pursuits.

W. N. Lockington read a paper on the anatomy and classification of Echni or sea urchins.

Dr. Kellogg described a new species of the order Compositæ, which he named Brickellia multiflora:

Brickelia multiflora.

BY DR. A. KELLOGG.

Stem 1—2 feet, woody, perennial, white, striated, erect; heads very small, (about five lines long,) 3 —4-flowered, compound leafy racemes panniculately

massed, oblong-pyramidal, terminal and axilliary racemelets clustered; leaves alternate, short petiolate, ovate-oblong, corneous, acute, entire (or sub-entire,) triplinerved, impressed glandular alike above and below, varnished and viscid, strongly recurved. Involucre 3—4-flowered, scales in 4—5-series, outer shortest, ovate, acute, varnished, viscid, granular and glandular, intermediate lanceolate, oblong, acute, scarcely puberulent, deeply striate-nerved, interior linear, elongated, mostly obtuse scarious, longer than the pappus, shorter than the corolla; corolla ochroleucous, five-toothed border expanded, branches of the style exserted obtuse, clavate, glabrous; pappus white, single, very minutely villous, much shorter than the corolla; achenia 10-striate, striæ sparsely pubescent.

On dry rocky ledges of Sierra Nevada Mountains. Two or three feet high, spire shaped top; leaves varnished alike above and below, 1—2 or more inches long, $\frac{1}{2}$—2 wide. Myriads of flowerets with thread-like branches of styles protruding, give it a yellowish hue, and the inner elongated scales glistening with white, so spangle the eye as to give it a peculiar arid appearance, notwithstanding the varnished green leaves intermixed.

President Davidson gave a very interesting account of the irrigation works now in course of construction in British India. The paper was accompanied by maps and diagrams.

Dr. Hale of New York mentioned a curious case of mimicry observed by him in the Santa Cruz Mountains, viz: a small spider exactly resembling the flower of the *Madroña* in color, size and form.

Regular Meeting, April 17th, 1876.

President in the Chair.

The following new members were elected: S. Lubeck (life), Joel F. Lightner, T. Bechtinger, J. K. Wilson, J. F. Meyers.

Robert Chalmers Lord was proposed as a candidate for membership.

Donations to Cabinet: Spider mimicking madroña flower, from Wm. Barber. Specimens of ore from Samuel Geddes, A. B. Stout, Barry & Patten, C. F. Kirchner, and Governor Purdy.

Captain C. Bryant, U. S. Treasury Agent to the Pribiloff Group of Islands, Behring's Sea, on the invitation of the President, gave an interesting description of the seal fisheries, and of the fur seal.

REGULAR MEETING, MAY 1ST, 1876.

President in the Chair.

Thirty-two members present.

Edward P. Morse, Walter Damenburg and Rudolph Thormann were proposed for membership.

Donations to the Museum: Rock Salt from T. J. Butler; marmolite containing gold, from Gov. S. Purdy; silver ore, (South Barcelona mine) from Louis Blanding; silver ore, (Leopard mine) from Mr. Marshall, through Henry Edwards; ten specimens Amianthus; specimens of common salt; forty-five specimens of copper ore from Inyo and Placer Counties, argentiferous galena, flint nodule, from C. D. Gibbes; specimens roofing slate and purple slate, from Gen. John Hewston, Jr.; rock salt, from H. Robinson; six specimens rich gold quartz and amianthus, from Dr. J. M. Hill; *Mus decumanus*, from Wm. Barber; beetles from India, from Prof. Davidson; *Tubicola longipes*, from W. N. Lockington; *Lockingtonia fluvialis*, and *Alloniscus masculosus*, from W. G. W. Harford; four specimens of birds, from W. G. Blunt.

The President spoke of the tarantula, and presented and quoted P. Martin Duncan to correct a misapprehension concerning the insect.

Dr. Blake presented a specimen of infusorial earth obtained from the hills about a quarter of a mile south of the N. E. end of Lake Merced. The deposit was known as the "chalk mine," and a considerable quantity of it had been sent to the Eastern States, as he understood, for the purpose of polishing glass. The deposit has been opened on the side of the ravine. So far as exposed, it appears to form a continuous stratum which has been cut into so as to expose a section of about four feet in thickness, although it probably is much thicker, as the whole hill for some distance seems to be formed of it. It was traced, cropping out at intervals, a distance of 300 yards to the west of where it had been opened, beyond this to the west the surface of the hill was covered by shifted sand. The bed has a dip of about 20°, a little to the E. of S., and appears to be undisturbed. The highest part of the outcroppings is at an elevation

of about 200 feet above the sea, and the bed probably belongs to the Pliocene formations that are found cropping out along the beach to the south of Lake Merced. The deposit has been formed in this laminæ, and between some of these, ripple marks left by the retreating tide, are perfectly preserved, as in the specimen presented this evening. A microscopical examination of the rock shows that it is made up of silicious particles, evidently of organic origin, probably the remains of diatoms, but no perfect diatom has been discovered. The earth would seem to be composed almost entirely of the remains of the silicious external covering of the diatoms. The more tenacious lamina that have preserved the ripple marks, contain a considerable quantity of clay.

W. N. Lockington read the following paper describing a new species of Colubrine Snake:

Description of a New Genus and Species of Colubrine Snake.

BY W. N. LOCKINGTON.

Bellophis nov. genus.

Body deeper than wide except near the head. Head and fore part of body depressed. Head much wider than the neck with an obtuse snout. Scales smooth, rhombic. Cephalic plates normal. Nasal plates, 2; the nostril near the posterior edge of the anterior plate. A small rectangular breal. A large ante-orbital and two post-orbitals; the lower smaller, partly in a notch between the fourth and fifth labials. Upper labials, 6—7, the centre of the eye over the commissare noiomma, between the third and fourth.

Dorsal rows of scales, 23. Abdominal scutellæ more than 190. Last abdominal scutella entire. Sub-caudal 45, divided. Tail short, about one-seventh the length of the body.

General color—Rings of red, white and black, the abdomen lighter but with traces of the same colors.

Bellophis zonatus. nov. sp.

Rostral plate broad; vertical, almost straight along its anterior edge; temporal shields large. Two pairs of ventral scutellæ, those of the opposite sides closely applied to each other. Nostrils large, infundibuliform. Scales rhombic, increasing in size from back to sides. Snout, top of head and chin black, then a ring of white over the head, continuous with the white of the throat. About 62 black rings from head to end of tail, the first ring just behind the occipital plates. The spaces between the black rings filled alter-

nately with rings of red and white, of which there are 29 of the former color, and 32 of the latter, without counting that on the head.

The difference in number between the red and white rings arises from the fact that the red rings die out upon the hinder part of the tail, which has white rings only.

The red rings in many cases do not cross the back, but are divided by the junction of a pair of black rings. The black rings become wider on the centre of the back, approaching, and in most cases, joining each other in pairs, but always at the expense of the red rings, the white rings being invariably continuous with the white of the abdomen. There are traces of red on parts of the abdomen, and the black rings can generally be partially traced across the abdominal scutellæ.

The specimen in this collection has six upper labials on one side, and seven on the other, the sixth and largest on the left side, being represented by two shorter plates on the right side.

Length of body, 13 inches; of tail, 2 inches.

Abdominal scutellæ, 198; sub-caudal, 45; dorsal rows of scales, 23.

Locality, Northern California. Presented and collected by Paymaster Stanton, U. S. N.

In Baird & Girard's catalogue, p. 153, Blainville's description of *Coluber zonatus*, of which those authors had seen no specimens, is given, and appears to agree in most particulars with the species here described, but the nostrils are hollowed out of the anterior nasal, and the color is different. Blainville describes his specimen as "Reddish white, entirely annulated with deep black, with two half rings of the same color on the head." It is very probably the same species, and for this reason I have preserved his specific name of *zonatus*, but the entire last abdominal scutella, want of carination of dorsal scales, and smaller number of abdominal scutellæ, appear to me to necessitate the formation of a new genus.

W. G. W. Harford read a paper describing a new genus and three new species of Sessile Eyed Crustacea.

Description of a New Genus and three New Species of Sessile Eyed Crustacea.

BY W. G. W. HARFORD.

Lockingtonia. n. g.

Antennæ *not* appendiculate. First three segments of the pleon dorsally carinated, and posteriorly produced to an acute point. Three posterior segments of the pleon *not* furnished with fasciculi of spines on dorsal surface. Eyes, round. Telson, single. Habitat, fresh water.

The above genus agrees with Dexamine and Atylus in its non-appendiculate antennæ. It differs, however, from the former in having the first pair of gnathopoda chelate, three instead of four anterior segments of the pleon dorso-posteriorly produced to a sharp point, and from the latter in the man-

dibles wanting the palpiform appendage. It is removed from Gammarus proper by having no fasciculi of spines on dorsal surface, no appendage to the antennæ, and a single telson. This is a very common Amphipod in nearly all our lakes and small streams, and it is somewhat remarkable that it has until now escaped detection. It occurs in great numbers in Lobos Creek, where our specimens were obtained; also in the streams of Alameda County, and I doubt not, may be found in any of the permanent fresh water ponds or streams along our Coast for a considerable distance north and south of here.

It is with pleasure that I dedicate this genus to Mr. W. N. Lockington, whose ability and industry has accomplished so much towards an orderly arrangement of the Crustacea in our Museum, thus giving us an invaluable cabinet of reference for those who desire to pursue investigations in this interesting department of zoölogy.

Lockingtonia fluvialis. n. s.

Superior and inferior antennæ setose. Superior a little more than half the length of the inferior antennæ, and much longer than their base. Terminal joint of inferior antennæ longer than the preceding; flagella twelve jointed. Flagella of superior antennæ ten jointed. Caudal stylets and legs setose; the latter especially so at the joints. Hand oblong-ovate, palm setose, oblique. Carpus produced posteriorly along the proximal side of the manus.

Hand of first pair of gnathopoda chelate.

Length, $\frac{6}{10}$ inch.

Alloniscus maculosus. n. s.

Cephalon slightly transverse, rounded in front. Outer joint of inner antennæ sub-clavate, with four spines on its summit. Outer antennæ spinulose at the joints. Flagellum multiarticulate, setose at joints. Last joint of outer antennæ about one-third longer than the preceding. First segment of the pereion longer than the 2d, 3d, 4th or 5th. The 6th and 7th shortest. The lateral margins of the first two segments of the pleon concealed under the seventh of the pereion. Color light brown above, with yellowish brown spots, becoming darker in alcohol.

Length, $\frac{7}{10}$ inch.

This is doubtless identical with some specimens of this genus which Prof. Dana had before him while describing his *Alloniscus perconvexus*, and which he says may probably be another species, Proc. Phil. Acad. 1854, p. 176. It is very near *A. perconvexus*, but may be readily distinguished from it by its light brown color above, with yellowish spots, and its still lighter colored limbs, which are minutely spotted with reddish brown, and its more slender form.

We found our specimens on Angel Island among fern roots, *Woodwardia radicans*, early in March last. A few only obtained.

Asellus Tomalensis. n. s.

Head a little transverse, narrower than the body. Upper antenna not reaching to the extremity of the peduncle of the lower. Flagellum of lower

antennæ longer than its peduncle. Body narrow in front, gradually increasing in width towards the tail.

Peduncle of caudal appendages more than half the length of the terminal filaments.

Length, $\frac{8}{20}$ inch.

This interesting little Isopod was recently obtained by Mr. W. N. Lockington while collecting at Tomales Bay and vicinity, and is, so far as I am aware, the first example of the genus found on this Coast. In that excellent work, "British Sessile Eyed Crustacea" (Bates & Westwood), two species are accredited to N. A., but we find no mention of them by any American author we have applied to, and it is most probable that they were from the eastern part of the continent. We therefore venture to offer this as new. A single specimen only was found, although several casts of the net were made. It would seem, therefore, very uncommon in that locality. We hope, however, that by diligently searching the fresh water ponds and streams along our Coast it may be found in greater numbers, with, possibly, other species of the genus. I hope that collectors will carefully examine our fresh waters for this Crustacean, thereby enhancing the value of our cabinet, and aiding students in acquiring a knowledge of these very interesting little creatures.

W. N. Lockington read the following description of a new genus and species of Decapod Crustacean and the male of Phyllodurus abdominalis:

Description of a New Genus and Species of Decapod Crustacean.

BY W. N. LOCKINGTON.

Family PINNOTHERIDÆ.

Tubicola. nov. gen.

Carapace extremely broad; fourth pair of legs much elongated, fifth pair rudimentary.

Habitat, the inside of the tube of an annelid.

Tubicola longipes. nov. sp.

Carapace broad, transverse, more than twice as wide as long; front occupying about one-third of the width of the carapace; antero-lateral margins broadly rounded; postero-lateral somewhat concave, the two meeting at an acute angle in the middle of the side of the body; posterior margin straight.

Branchial regions largely developed, tumid; a long transverse depression in the carapace behind the gastric region; antero-lateral margin bordered by a fringe of setæ.

Third joint of external maxillipeds very small; second joint stout and large.

First pair of legs short, with short carpus and flattened elongated manus having a fringe of setæ on its upper border.

Second and third pairs of legs sub-equal, longer than the first, slender, ending in a sharp claw; the third pair slightly longer than the second.

Fourth pair immensely developed, exceeding in length the width of the carapace, terminating in a stout claw.

Fifth pair shortest, reaching to about the middle of the third joint of the fourth pair; usually held in an elevated position over the posterior portion of the carapace.

Width of carapace a little less than ¼ inch; length, ⅛ inch.

Total length from claw to claw at fourth pair, ¾ inch.

Habitat, the sand-constructed tube of an annelid.

I found this curious little crustacean on the tube of an annelid common on the sandy flats left bare at low tide in Tomales Bay. While digging for those sand-excavating lobsters, the *Gebiæ* and *Callianassæ*, I found in abundance the sandy tubes of an annelid about six inches long, with numerous joints or nodes, each of which was surrounded by a circlet of setæ, by whose action the creature propelled itself at pleasure up and down the tube.

Believing the worm to be a new species, I gathered some, and while pulling the tube to pieces, and admiring the rich brownish red tint conspicuous at each node of my new prize, I was surprised to see a long narrow creature move out, as I believed, head first; but a nearer inspection showed me that the motion was sideways, and that the new-comer was no fourteen-legged amphipod or isopod, but a true decapod crustacean.

The short chelæ, extremely lengthened fourth pair of legs, and short, broad body, are so many adaptations to the mode of life of this creature, which finds an ample dwelling-place in the space intervening between the body of the annelid and the inside of the tube; up and down which it moves with its long fourth pair stretched out in such a manner as to to give it the elongated appearance of a *Caprella*.

The width of *Tubicola longipes* from end to end of the fourth pair of legs is eight times greater than its length from front to back.

This is, so far as I am aware, the only instance known of a decapod crustacean becoming the guest or commensal of an annelid, for although the species of the family *Pinnotheridæ* are all commensals, most of them reside between the folds of the mantle of large bivalve mollusks, such as mussels or clams (thus the *Fabia subquadrata* lives within the mantle of *Pachydesma crassatelloides*, a large clam of this Coast), and a few live within the tests of Echini, close to the anal aperture.

It is most probable that this worm and its commensal may occur in many other places besides Tomales Bay, possibly in San Francisco Bay, and I should be much obliged if some of our friends who may go out on a fishing excursion would bring me specimens, in alcohol, of the worm and its tubes, that I may find whether the crab is its constant companion in all localities.

The worm is one which is frequently used for bait.

On April 20th, the females of this interesting little crustacean was loaded with spawn.

Phyllodurus abdominalis. Stimpson.

When Stimpson, in his Crustacean and Echinodermata of the Pacific Shore of N. A., page 71, first described this species, the female only was known to him. This female, like all those belonging to the family *Bopyridæ*, is of comparatively large size, broad and clumsy in appearance, and lives attached to another crustacean.

The crustacean frequented by this commensal is *Gebia pugettensis*, a marine crayfish common on these shores.

About April 24th, I gathered a great number of Gebias in Tomales Bay, and found that most of them, all except the largest specimens, had a female *P. abdominalis* attached to one of the abdominal pairs of feet, to which it clung closely by means of its hooked claws.

A close inspection revealed, beside or near the large female, a small and slender male, a kind of miniature edition of its stout mate.

Never more than a single pair were ever found attached to one Gebia, but the males appeared so regularly to accompany the females, that I believe that in the few cases I did not find them, it was because they had dropped off in handling the specimens.

The males do not live attached to the Gebia, but are free to rove, and their constant presence at this season by the side of the females proves that this is their season of love.

Male. Head semi-circular anteriorly, closely united to the succeeding segment. Third and fourth thoracic segments widest. Body oblong, boat-shaped, tapering slowly from the fourth to the seventh thoracic segment.

Outer antennæ four-jointed; inner very small, reaching about to the middle of the second segment of the outer.

Eyes too small to be distinguished by a Coddington lens.

First abdominal segment a little narrower than last thoracic, but flat; succeeding segments tapering rapidly to the sixth or telson, which is pointed at the end, and is provided on each side with a small lamella, giving the whole telson somewhat the appearance of a spear-head.

The lateral laminæ of the first five abdominal segments round in sections instead of segmental, as in the female, and considerably longer than the width of the segments to which they are attached.

The President referred to a letter on the subject of irrigation sent to him by P. J. Flynn, and explained some of the errors into which he had been led.

The President read a continuation of his paper on Irrigation in India, Egypt and Italy.

The President communicated to the Academy, by the authority of the Superintendent of the Coast Survey, the following memoranda:

Determination of the Difference of Longitude, by the Electric Telegraph, between the U. S. Coast Survey Stations at San Francisco, California, and Seattle, Washington Territory.

Date.	Seattle East of San Francisco.		Mean.	△	Double Time of Retardation.	Time of Retardation.
	Seattle Signals.	San Francisco Signals.				
1871.	*S.*	*S.*	*S.*	*S.*	*S.*	*S.*
Sept. 12....	18.22	18.48	18.35	0.09	0.26	0.13
13....	.22	.51	.37	.07	.29	.15
14....	.25	.74	.49	.05	.49	.24
19....	.31	.62	.47	.03	.31	.15
21....	.33	.76	.54	.10	.43	.21
28....	.30	.57	.44	.00	.27	.14
30....	.24	.61	.42	.02	.37	.18
Oct. 2....	.30	.62	.46	.02	.32	.16
8....	.25	.57	.41	.03	.32	.16
9....	.27	.59	43	.01	.32	.16
12....	.24	.56	40	.04	.32	.16
14....	.38	.70	.54	.10	.32	.16
15....	.28	.62	.45	.01	.34	.17
	18.276	18.612	18.44	....	0.34	0.17

			S.	*S.*
Correction for personal equation			— 0.02	± 0.01
			S.	*U.*
Resulting difference of Longitude			18.42	± 0.02
	H.	*M.*	*S.*	*S.*
Telegraphic Longitude of San Francisco station	8	09	38.35	± 0.08
Hence Longitude of Seattle	8	09	19.93	± 0.08
Or in Arc	122°	19′	58.59	± 1.2″

Observer at San Francisco, George Davidson.

Observer at Seattle, S. R. Throckmorton, Jr.

Communicated to the California Academy of Sciences by authority of the U. S. Coast Survey, April 17th, 1876.

REGULAR MEETING, MAY 15th, 1876.

President in the Chair.

Twenty-one members present.

The following new members were elected:

H. W. Reese, Albert Arents, C. A. Luckhardt, Emlen Painter, Louis Falkenau.

Donations to the Museum: From Lieut. Murray S. Day, U. S. Navy, the following articles from the "Ainos" of the Islands of Yesso, Japan: one bow and three arrows, one of which is prepared with poison; one piece of Aino cloth made of the inner bark of the Mikapp, a kind of ash; also sword used in making the cloth; one fisherman's knife; one pair Aino socks, made of bark; one pair of winter shoes, made of salmon skin; one "Passu," or moustache lifter, used in the drinking ceremony for lifting the moustache; one hat, made of bark twine; one musical instrument, called the "Ka," played with four strings and two bridges. From C. D. Gibbes, thirty specimens of silver, copper, native copper, cinnabar, pyrites and quartz crystals. From A. H. Nahor, specimens of silicified wood and gold-bearing cement from Iowa Hill, Placer Co., Cal. From G. A. Treadwell, thirty-three specimens of ore. From W. Collis, a specimen of oak with a piece of some kind of mineral in the centre. From Henry Edwards, specimens of marmoratus, ostracion, Pegasus and Grapsus. From W. G. Blunt, specimens of Segnathus, and eggs of some of the Rhinotalidæ. From Geo. Davidson, Coleoptera from Egypt.

Mr. C. D. Gibbes read some remarks on the minerals presented at the last meeting.

Professor George Davidson read a continuation of his paper on Irrigation in India, Egypt and Italy.

REGULAR MEETING, JUNE 5TH, 1876.

President in the Chair.

Thirty-seven members present.

The following new members were elected: Rudolph Thormann, L. L. Hawkins, Walter W. Dannenberg, Edward N. Moor, and Robert Chalmers Lord.

Donations to the Museum: From E. S. Holden, lignite from coal mine, Alameda County. Bog iron ore from Calaveras County; portion of tarantula nest. From Thomas Holmes, red hematite from Nevada. From C. D. Gibbes, anthracite coal from Pennsylvania. From A. B. Stout, trachite from Sonoma County. D. Buck presented silver ore from Lee District, Inyo County, Cal. From Henry T. Compton, fifty eggs. From W. N. Lockington, four specimens of fish, and eggs of the spotted shark. From T. J. Butler, Arizona parasitic plant. Bamboo plant from Professor Davidson. From James Lick, fossil tooth found in digging road to new observatory on Mt Hamilton.

Henry Edwards presented a paper on Pacific Coast Lepidoptera, No. 17.

Pacific Coast Lepidoptera—No. 17. On the Transformations of Colias (Meganostoma Reak) Eurydice, Bdv.

BY HENRY EDWARDS.

Some five years since I observed that the females of this rare and beautiful butterfly were in the habit of hovering over the singular Leguminose plant, *Amorpha californica*, Torrey, and upon one occasion, I thought I detected one in the act of laying her eggs, but the most careful search for such demonstration, though followed over the whole bush by the aid of a pocket lens, failed to establish the fact, and I believed that I had been deceived, and that the food-plant of the species must be sought for elsewhere. Two years ago, however, the same circumstances re-occurred, and in this instance, I noticed six different females alight upon bushes of *Amorpha*, and proceed as insects usually do in the process of the deposition of eggs. I again searched these bushes, and again without success, and I was led to the somewhat wild conclusion that the eggs are deposited at random, and allowed to drop to the ground at the base of the plant; the instinct of the parent trusting to the power of the

young larva to find its proper food, when, after its winter sleep, the plant should put forth its spring adornment. The *Amorpha* is particularly local, and not easy of cultivation, so I had no means of following up my observations, but by travelling some miles to the spots in which the plant happens to grow, and these being at a distance of from 30 to 100 miles from San Francisco, the opportunities afforded me were but few. Every season, however, I followed up the small trail which I had struck, and this year, I was fortunate enough to have my hopes of the discovery of the earlier stages of this charming species crowned with complete success, and at White Sulphur Springs, Napa Co., on the 7th of May last, I had the extreme gratification of seeing the caterpillar for the first time. Upon some plants of *Amorpha*, which very specimens I had carefully searched for five years, I found 19 examples in different stages of growth; and have since had the satisfaction of seeing all transform to the chrysalis state; and some few reach the imago. The species appears to be as delicate in physical habit as its colors are beautiful, and it feeds exclusively upon the plant on which it was originally found. I tried the caterpillars with *Psoralea*, *Astragalus* and *Hosackia*, among Californian plants, and with *Cassia* and *Swainsonia* among exotics, but it would eat none of them, and no matter how dry the leaves of its own food might be, it devoured them readily, and appeared to thrive. The result of my first experiment with this species has been as follows:

The full grown larvæ began to change to the chrysalis on the 9th of May, and by the 14th, all had gone into that stage; the first imago emerging on the 28th. I should add that in addition to the 19 nearly full grown larvæ which I brought successfully to the chrysalis state, I found four younger ones, two of which had scarcely passed the second moult, the other two being a little older. The whole of these, however, died soon after my reaching home. I have raised out of my 19 caterpillars, seven males and four females, seven of the remainder dying in the chrysalis stage from some singular disease. Without any mark to proclaim any kind of sickness, about the third or fourth day after the transformation, a livid spot appeared upon the base of the abdominal region, and in two days more this was extended to the whole surface. By the end of the 10th day, the chrysalis had assumed a blackish hue, and withered completely away, leaving only the dry husk to tell the tale. No parasite has emerged from these specimens, nor does it appear likely that any such event may happen, as the remaining specimen was infested by a large Dipterous insect, common to many species of Lepidoptera which has already produced its imago. I regret that a knowledge of the egg has so far escaped me, but I hope to be able to furnish this fact before the close of the year. Mr. R. H. Stretch was kind enough to make a figure of the larva and chrysalis, which will be published in Mr. W. H. Edwards exquisite work on the Butterflies of North America. In the meantime I offer the following description:

Larva. General color pale yellowish green. Head rather small, bluish green, with a few short hairs in front. Body entirely covered with minute black irrorations, with a faint indication of a pale dorsal stripe. There is a very distinct white lateral stripe, enclosing the spiracles, which are bluish white, and are surrounded by a yellow dash. Above the spiracles are ten well-

defined black spots, around which the irrorations are thicker, forming a black cloud. Under side entirely whitish green.

Length, 1.45 inch.

Food plant, *Amorpha californica*, Torr.

Chrysalis. Entirely pale yellowish green, surface slightly wrinkled, the dorsal region covered with white specks. Beak very sharp, and broadly keeled. Thoracic protuberance a long, acutely-edged ridge. The yellow dorsal line is visible as in the larva. When the imago is abont to emerge, the wing cases assume a darker shade, until the pattern and color of the primaries of the perfect insect may be gradually but distinctly seen. After emergence, the chrysalis case is pure white, and very transparent and glossy.

Length, 0.95 inch.

Width across wing cases, 0.28 inch.

First imago appeared May 28th, the last on June 5th, the average time in chrysalis state being 19 days.

Professor Davidson read a continuation of his papers on "Irrigation in India, Egypt and Italy."

Mr. F. Gruber read the second of his course of lectures on ornithology, illustrating his remarks with specimens prepared by himself. This lecture treated particularly of "Birds of Migration and Song."

Regular Meeting, June 19th, 1876.

Vice-President Hyde in the chair.

Fourteen members present.

Donations to the Museum comprised a large gopher snake, from W. G. Blunt.

Mr. Dameron described a recent visit to Mt. Tamalpais, in Marin County, which caused some discussion concerning the peculiar mark on the side of the mountain.

Regular Meeting, July 17, 1876.

Vice-President Edwards in the Chair.

Twenty-five members present.

Donations to the Museum: From M. D. Hyde, vial of mud from soundings made from the "Tuscarora." From Henry Edwards, *Hyla*, sp., *Eutœnia sirtalis*, *Allorchestes plumulosus*.

In the donations to the library was a volume of the "Botany of California," to which the Vice-President called particular attention. It is now published through the munificence of certain of our citizens, the State Geological Survey having been discontinued, and no money having been appropriated to publish this work. As Judge S. C. Hastings had been mainly instrumental in obtaining the money by means of which the publication of the work was insured, a vote of thanks to that gentleman was passed by the Academy.

W. N. Lockington submitted the following:

Check List of the Decapod and Tetradecapod Crustacea of the West Coast of North America.

BY W. N. LOCKINGTON.

The appended list contains 231 species, collected from the writings of Dana, Stimpson, S. I. Smith and Hale Streets, with the addition of above forty recently described by Mr. W. G. W. Harford and myself.

It is not unlikely that other Panaman and Arctic forms may have been described by American and European naturalists, whose works are not accessible to me; but I have worked in the belief that a check list was wanted, and that the only way to have one was to avail myself of the materials at hand—in the hope that those who have better materials, or more of them, will either be so good as to send me their additions or corrections, or will publish a fuller and better list.

Even if this list should prove complete, or nearly so, as regards species hitherto described, it probably does not contain the half of those actually existing on the long line of coast stretching from Panama to the Arctic Ocean.

Only the more conspicuous species from the coast north of Monterey have hitherto been described, while south of that old city, and extending almost to Panama, lies a vast region which, so far as I am aware, has scarcely been searched at all for Crustacea, though its birds, reptiles, fishes and mollusks have been pretty thoroughly studied.

Numerous Decapoda from Panama and Nicaragua have recently been described by S. I. Smith, and others by Hale Streets, yet the series of new forms given by them must be considered only as a sample of the riches of that region.

Even in and around San Francisco Bay we have found several new species of Tetradecapoda, and probably a systematic dredging would bring to light many more.

Very little dredging has been done along the coast, and that little has been confined to comparatively shallow depths.

The fresh-water streams and lakes of California, as well as those of Mexico, have yet to yield their quota of species for some future check list.

The Entomostraca and Cirripedia as yet described are very few, and these departments offer a large and inviting field to the naturalist.

It is my intention, from time time, to furnish the Academy with additional notes of the species already known, as well as descriptions of such new species as may be sent to us.

Some few of the new species included in this list may, without doubt, prove to have been already described, but I feel assured that this will only be the case with Alaska forms, some of which may probably range throughout the Arctic Seas, inhabiting both North Pacific and North Atlantic.

The names of the naturalists who have described species are given in full throughout this list, with the exception of Stimpson, which is abbreviated to St.

The species at present in the collection of the Academy are denoted thus *.

DECAPODA BRACHYURA MAIOIDEA.

Chionœcetes Behringianus. St..............In deep water. Behring's Sts.
Hyas latifrons. St ....Behring's Sea.
Hyas coarctatus. Leach..............................Behring's Sts.
Hyas lyratus. Dana..........................In deep water. Oregon.
Herbstia parvifrons. Randall...................." Western America."
*Libinia? verrucosa. Lockington..............................Mazatlan.
*Loxorhynchus grandis. St..............................Santa Barbara.
Loxorhynchus crispatus. St..............................San Miguel.
Omalacantha hirsuta. Hale Streets..............................Panama.
*Inachus tuberculatus. Lockington ....
*Pisoides? tumidus. Lockington..............................San Diego.
*Microrhynchus ? Hemphillii..............................San Diego.
Libinia affinis? Randall......... Variety of *L. canaliculata*. " Upr. Cala."
Chorilia longipes. Dana..............................Oregon.
*Scyra acutifrons. Dana..........................Puget Sd., San Diego.
Othonia picteti. De Saussure..............................Mazatlan.
Mithraculus coronatus. St..............................Panama.
Mithrax armatus. De Saussure..............................Mazatlan.
Oregonia gracilis. Dana..............................Puget Sd.
Oregonia hirta. Dana..............................Puget Sd.
*Pugettia gracilis. Dana..............................Puget Sd.

Regular Meeting, July 17th, 1876.

Vice-President Edwards in the Chair.

Twenty-five members present.

Donations to the Museum: From M. D. Hyde, vial of mud from soundings made from the "Tuscarora." From Henry Edwards, *Hyla*, sp., *Eutœnia sirtalis*, *Allorchestes plumulosus*.

In the donations to the library was a volume of the "Botany of California," to which the Vice-President called particular attention. It is now published through the munificence of certain of our citizens, the State Geological Survey having been discontinued, and no money having been appropriated to publish this work. As Judge S. C. Hastings had been mainly instrumental in obtaining money by means of which the publication of the work was insured, a vote of thanks to that gentleman was passed by the Academy.

W. N. Lockington submitted the following:

Remarks on the Crustacea of the Pacific Coast of North America, including a Catalogue of the Species in the Museum of the California Academy of Sciences, San Francisco.

BY W. N. LOCKINGTON.

The collection of Crustacea belonging to this institution is tolerably complete as regards the species inhabiting the Pacific Coast from Cape St. Lucas northwards, and also includes many forms from Oceania and the Indo-Pacific, but is deficient in Atlantic, African and Australian forms.

The Pacific Island specimens are, for the most part, the gift of Andrew Garrett; while those from this coast, to which these remarks are confined, have been presented chiefly by W. J. Fisher, Hy. Hemphill, Hy. Edwards and W. G. W. Harford.

MAIOIDEA.

The want of a good scientific library on this coast is severely felt by any one who attempts to describe a new species, and I have never felt it more acutely than when endeavoring to marshal in their proper places the numerous novelties belonging to this group of Crustacea that have been brought from the Gulf of California by Mr. W. J. Fisher.

Without type specimens of any of the European or Atlantic coast genera, with abridged descriptions of many genera, and nothing but incidental allusions to others, coupled by a reference to works inacessible to me, the task of identification is a hard one, and I therefore crave indulgence if, in one or two cases, a new genus has been founded where an old one would have fitted, or a species has been described as new because I have not seen the description.

The total number of species of Maioid crabs now known upon this coast, including the *Parthenopidæ*, two or three forms that may possibly be synonymous, and one, the locality of which is doubtful, is thirty-nine, of which nineteen only are included in Stimpson's "Crustacea and Echinodermata of the Pacific Coast N. A.," published in 1857.

Eleven new species are described in this paper.

Family MAIIDÆ.

Sub-fam. INACHINÆ.

1. *Microrhynchus* (*Inachus*) *tuberculatus*. Lockington. Proc. Cal. Acad. Sci. Feb. 7, 1876.

The rostrum in this species is entire, whereas in *Inachus scorpio* it is emarginate and shorter; moreover, the proportionate lengths of the second pair and the carapax are rather those of *Microrhynchus* than of *Inachus* (as given by Dana.)

The present species does not appear to be very abundant, as Mr. Fisher obtained only two specimens on the West coast of Lower California.

No. 1. Two specimens, male and female, dried. San Diego. Hy. Hemphill.

2. *Chionœcetes Behringianus*. Stimpson. Crust. and Echinodermata Pac. Shores N. A., p. 8. At 80 fathoms, off Cape Romanoff.

PISINÆ.

3. *Hyas latifrons*. Stimpson. Prod. Animal. Evert. Ocean, Pac. Septen., 24.

Like *H. coarctatus* but with the body shorter, wider in front, less tuberculated above, and with obtuse angles; the rostrum shorter and less acute, and the fissure of the superior margin of the orbit closed.

Common in Behring's Straits.

The Cal. Acad. Sci. possesses a single specimen of this species.

No. 1*a*. Alaska, dried. W. J. Fisher.

4. *H. lyratus*. Dana. Crust. U. S. Ex. Exp. 1, p. 86, plate 1, fig. 1. Stimpson. Crust. and Echi. Pac. Shores N. A., 10.

Deep water on the coast of Oregon.

5. *H. coarctatus*. Leach. Malac. Pod. Brit. pl. XXI, b. Milne Edwds. Hist. Nat. des Crust. 1, 312. Brandt. Sibirische Reise, 1, 79. Stimpson. Crust. and Echi. Pac. Shores N. A., 10.

Behring's Straits.

Herbstia parvifrons. Randall. Jour. Acad. Nat. Sci. Phil., VIII, 109 Gibbes, Proc. Amer. Assoc. for Advancement Sci., 170. Stimpson. C. & E. P. C. N. A.

Dr. Randall's description of this species is very imperfect. Stimpson and Gibbes give no description, but simply refer to the specimen in the Philadelphia Cabinet. "Western America, *Nuttall*."

It is not improbable that one of the species described further on may be identical with this.

7. *Platypes edentata*. Lockington. Proc. Cal. Acad. Sci., March 20, 1876.

La Paz, 3 fms. Port Escondido, Mulege Bay. Mazatlan.

By an error in my original description, the "manus" of the first pair of limbs was stated to be alveolate on its upper edge. It is the merus that is alveolate. The extremely broad depressed appearance of the four hinder pairs is mainly due to the abundant tomentosity of their anterior and posterior margins, yet the limbs themselves are considerably flattened.

The first pair of limbs, in alcoholic specimens, are of a bright, shining carmine tint. The shape of the carapax is that of the *Pisinæ*, but the bifid rostrum renders its position doubtful.

No. 12. Female and two young specimens, dried. Mazatlan. Hy. Edwards.

No. 18. Male and female, in spirits. Gulf of California. Fisher and Lockington.

8. *Loxorhynchus grandis*. Stimpson. Crust. and Echi. Pac. S. N. A., 12.

Stimpson says of this species, "taken off the coast of California, near San Francisco." I have never heard of this crab in this locality, and it is never brought to market.

The Museum of the Cal. Acad. Sci. possesses two dried specimens, one, a male, from Santa Barbara, the other, a female, from Santa Catalina Island.

No. 10. Male. Santa Barbara. Mr. Lorquin.

No. 11. Female. Santa Catalina Island.

9. *Loxorhynchus crispatus*. Stimpson. Crust. and Echino. P. S. N. A., 13.

I have not seen this species.

10. *Homalacantha hirsuta*. Hale Streets. Proc. Acad. Nat. Sci. Phil., 1871, 238.

Panama.

Ala. nov. gen.

Rostrum bifid to base, deflected downwards; fixed joint of outer antennæ broad, the outer apex continued into a long spine in the same plane with the

rostrum. Antero-lateral teeth triangular, the two posterior forming a broad wing-like expansion.

The proper place of this genus is evidently among the *Pisinæ*, and its affinities with *Rhodia* (Bell) and *Herbstia* (Edwards), but the form of the carapax and of the first joint of outer antennæ does not agree with either, while from the former it differs in having the first pair slightly longer than the second; and from the latter (at least from *H. cordyliata*,) in the presence of a pre-orbital spine.

11. *Ala spinosa.* nov. sp.

Carapax with broad lateral expansions rendering it wider than long. Rostrum, bifid, shorter than the base of the external antennæ. Movable basal points of antennæ short. A long spine, exterior to the antennal base, projecting nearly as far forward as the rostrum. An acute spine on the upper anterior margin of orbit, and a much smaller post-orbital. Antero-lateral spines three, beside the post orbital; the second and third forming the wing-like expansions of the carapax. Of these, the second is the largest, and the third is short anteriorly, but has a long thin posterior border. Upper surface of rostrum with two rows of hairs. Ten tufts of hairs on the gastric and intestinal regions, corresponding to the tubercles of those surfaces. Postero-lateral and posterior margins of carapax with a row of tufts of hairs. Chelipeds of equal proportions in both sexes, very slightly longer than the second pair; arm tubercular above, carpus ditto, manus smooth and slender; dactyli in contact, in female, gaping in male; the parts in contact serrated on inner edge, extremities pointed. Hinder pairs beset with spines, each spine terminating in a bunch of hairs. Abdomen of female surrounded by a fringe of hairs.

Localities: La Paz, San José Island, Port Escondido, Gulf of California.

	♂ M. M.	♀ M. M.
Length of carapax	22	24
Width of " across lateral expansions.	23	26

Almost all the specimens are female, their abdomens laden with ova. They were taken in August or September.

No. 14. Male and female, in spirits. Fisher and Lockington.

12. *Pisoides? celatus.* nov. sp.

Carapax triangular ovate; branchial, cardiac and stomachal regions prominent, tumid; rostrum short, bifid to base; fossettes and inner antennæ small; fixed joint of external antennæ very broad, with a long spine as its outer exterior border, this spine forming part of the orbit. A spine upon the upper surface of the carapax slightly behind that of the fixed antennal joint, yet somewhat in advance of the eye, this (pre-orbital) spine divided by a triangular notch from the post-orbital, behind which, on the antero-lateral border, are two smaller spines. On each branchial region a group of two or three conspicuous spines, and some smaller ones on the posterior margins. The ciliate movable joints of outer antennæ as long as rostrum, flagella about

three times as long as rostrum. Upper surface of carapax hirsute, especially upon the rostrum. Hinder part of sternum and abdomen tomentose. Chelipeds almost as long as second pair, without hairs; merus with about four teeth on its superior margin; carpus slightly tubercular; manus perfectly smooth. The movable finger occasionally has a tubercle between the base and the tip. Movable and fixed fingers serrated for half their length and interlocking on their outer margins. Hinder feet hirsute, short, a spine on the upper surface of the fourth joint of second and third pairs.

Color, reddish-brown above, the hands and under parts white, marbled with bright red, the latter predominating on the upper surface of the chelipeds.

Localities: La Paz, Mulege Bay, Port Escondido, San José Island, all in the Gulf of California.

It is found under stones at low tide, and was also brought up at La Paz by the dredge.

The females have no tubercle on the inside of the dactyli, and the spines upon the branchial region are not prominent. They were with ova when collected, in the month of August.

	♂ M.M.	♀ M.M.
Length of carapax	20	13
Width of carapax	17	12

The females are rather less elongated than the males. The carapax in both sexes is exceedingly overgrown with corallines, sponges, sertularia, etc.

No. 16. Two males and two females, in spirits. Fisher and Lockington.

This little crab evidently belongs to the *Pisinæ*, but does not fit well into any of the genera given by Dana. The characters are nearest those of *Pisoides* and *Herbstia*, but from the former it differs in the presence of a preorbital spine, and from the latter in the great width of the fixed joint of the external antennæ, as well as in the small size of the chelipeds.

I think it not unlikely that this form is the *Herbstia parvifrons* of Dr. Randall, (Proc. Phil. Acad. Sci., 1869, p. 107), but his description is so short that it is impossible to be certain; so far as it goes, however, the characters given agree.

13. *Pisoides? tumidus*. Lockington, Proc. Cal. Acad. Sci., Feb. 6, 1876.

I have received specimens of this species from San Bartolomé Bay and Magdalena Bay, all of them smaller than the type in the possession of the Academy. Those from Magdalena Bay were dredged in three fathoms.

The first article of the external antennæ is acute on its outer angle, but can scarcely be called a spine, the second and third are long, ciliated, and cylindrical, in the last character differing from the generic description given by Dana.

No. 6. Female. San Diego, between tides. Hy. Hemphill.

LIBININÆ.

Libinia canaliculata? Say.

14. *Libinia affinis?* Randall. Jour. Acad. Nat. Sci., Phil., VIII, 107. Gibbes, Proc. Am. Asso., 1850, p. 170. Stimpson, Crust. and Echi. Pac. S. N. A., 14. Hale Streets, Proc. Acad. Nat. Sci., Phil., 1870 p. 170.

I have lately found among the crustacea collected by Mr. Fisher, two fine specimens of a *Libinia*, from San Bartolomé Bay, Lower California. They are much larger than the specimens described by Randall, and without tubercles interspersed among the spines. The species consist of a central dorsal row of eight, the first of which is the central one of a transverse row of three on the anterior portion of the gastric region. Two of the dorsal row belong to the cardiac, and one to the intestinal region. Nearly in a direct transverse line with the first cardiac spine are two others on each branchial region; and in a direct transverse line with the second cardiac spine are a blunt spine or tubercle and two spines on each branchial region, thus forming a row of seven. Right and left of the intestinal spine is a small one on the posterior part of each branchial region. Rostrum but slightly cleft, setose at extremity and on upper surface, not at all deflected; ante-orbital spine much smaller than post-orbital, which is broad and curved posteriorly; two spines on each antero-lateral margin, and two smaller ones near together on each hepatic region, in a line between the anterior antero-lateral spine and the transverse row on the stomach. The outermost spine of the transverse row of seven is the largest. The feet are without spines or tubercles. The largest specimen measures as follows:

	M. M.
Length of carapax	52
Width of carapax, without measuring the spines	39

Both the specimens are female.

I have never seen a specimen of *L. canaliculata*, nor Randall's specimen of *L. affinis*, but it is unusual to find an Atlantic species existing unaltered at such a point as San Bartolomé Bay, remote both from the Isthmus of Panama and from Behring's Straits, and for this reason I should not be surprised if it should prove distinct, in which case I propose for it the specific name *setosa*, on account of its setose rostrum.

MICIPPINÆ.

15. *Micippa ovata*. nov. sp.

Carapax ovate, truncate in front, front narrower than in *M. hirtipes*, Dana. Post-orbital spine in the same line with pre-orbital, the two separated by a triangular notch. Antero-lateral margin with five sharp spines directed forwards, excluding the post-orbital, the lateral edge of which is elongated. Upper surface of carapax arched transversely, almost semicircular in section; tubercles numerous, but without spines. Chelipeds short, smooth, fingers serrate at tip. Hairs sparsely scattered on hinder feet and carapax, rostrum pilose, especially round the margin.

Localities: Port Escondido, Mulege Bay, Los Angeles Bay, San José Island, La Paz.

	♂ M. M.	♀ M. M.
Length of carapax	21	19
Width of carapax at third antero-lateral spine	18	16
Length of first pair	19	12.5

Var. *lævis*.

Rostrum, orbits, antero-lateral spines, and limbs exactly as previously described, but the carapax more broadly ovate, and without tubercles, and the chelipeds much larger in the male.

	M. M.
Length of carapax..	21
Greatest width at fourth antero lateral spine............	19.5
Length of first pair...........	30

This is a well-marked species, and exceedingly elegant in appearance. The male which I have described as var. *lævis* is the largest among several from various localities. The smooth carapax and large chelipeds render it conspicuous among the others, yet I am inclined to believe these characters only varietal, and not improbably only individual.

No. 20. Male and female, in spirits. Gulf of California. Fisher and Lockington.

CHORININÆ.

16. *Chorilia longipes*. Dana. U. S. Ex. Exp., 1, p. 81, pl. 1, fig. 5. Stimpson. Crust. and Echi. Pac. S. N. A., 14.

17. *Scyra acutifrons*. Dana. U. S. Ex. Exp ., vol. I, p. 95, pl. 11, f. 2 Stimpson. Crust. and Echi. P. S. N. A., 15.

No. 7. A single dried specimen from San Diego, by Henry Hemphill, caught between tides.

Chorilibinia. nov. gen.

Rostrum long, broad, and emarginate at tip as in *Libinia*, but the eyes concealed beneath it as in *Chorinus* and its allies. Pre- and post-orbital spines acute, separated above and below by an acute fissure, and together constituting the orbit. Carapax triangular.

18. *Chorilibinia angustus*. nov. sp.

Carapax triangular, narrowing gradually to the region of the eyes, the orbits of which are salient. Rostrum long, emarginate at tip, the bifurcation divergent, extending only one-third the length of rostrum. Fixed joint of external antennæ terminating outwardly in a long spine which precedes the pre-orbital when looked at from above. Pre-orbital spine large, acute, separated from the acute post-orbital by an acute fissure, both above and below. Antero-lateral margin with three spines beside the post-orbital, the largest spine at the angle between antero- and postero-lateral margins. Tubercles of carapax prominent, each culminating in a single spine. A tubercle with spine on the posterior angle. Movable basal joints of outer antennæ setose, slender, cylindrical. Chelipeds slender, about the same length as second pair; merus (arm) with four tubercles above; manus smooth, slender; dactyli small, slender, in contact most of their length, serrate on inner border. Four hinder pairs rounded, slender, second much the largest; claws sharp.

The whole of the upper and under surface, except the inner side of the hand and upper surface of the rostrum, tomentose, with longer hairs at intervals, and a row of the latter on each side of the rostrum.

Locality, Gulf of California.

	♂ M. M.	♀ M. M.
Length of carapax	20	23
Greatest width of carapax	12	15

Out of the three specimens in my possession the female is the largest, but has the rostrum shorter than the males.

19. *Othonia picteti.* De Saussure, Revue et Magasin de Zoologie, V, 357, pl. XIII. f. 2.

MITHRACIDÆ.

20. *Mithrax armatus*? De Saussure, Revue et Magasin de Zoologie, V, 335, pl. XIII, f. 1.

Either this species or the succeeding is most probably the *M. armatus* of De Saussure, but for the reasons given more fully under the next species, I cannot be certain of its identity, and therefore subjoin a description.

Rostrum bifid, the horns not lamellate; carapax broadly pyriform; verrucose throughout its upper surface, the verrucæ becoming spinose on the posterior portion of the carapace. Exterior side of the fixed joint of outer antennæ with a long spine at the extremity, followed by a shorter. A short pre-orbital spine, separated by a deep notch from the post-orbital. Margin of carapace with five large spines besides the post-orbital, four upon the antero-lateral, the fifth upon the postero-lateral margin. A second row of smaller spines upon the sub-branchial region. First pair of limbs short; dactyli not tapering, obtuse and imperfectly spoon-shaped at end; propodus oblong, more than twice as long as wide, smooth; carpus and merus spinose above, but without the smaller tubercles found on the carapax. Four hinder pairs slender, cylindrical; merus and carpus spinose above like those of first pair; propodus slightly hirsute, smooth; terminal joint (dactylus, tarsus) hirsute, ending in a recurved claw of an orange color. Abdomen six-jointed in the female. The whole of the upper surface of carapax and limbs, between the spines and tubercles, is finely punctate; and the whole of the lower surfaces tomentose.

A single female from Mazatlan, presented by Hy. Edwards, is the only specimen I have seen of the species.

	M. M.
Length of carapax to tip of rostrum	32
Width of carapax from tip to tip of fourth marginal spine	30
Length of first pair	28
Length of second pair	42

Color of the specimen a light flesh tint.

No. 3. Female, dry. Mazatlan. Hy. Edwards.

21. *Mithrax areolatus.* nov. sp.

The only species of *Mithracinæ* that have been, to my knowledge, previously described from this coast are the *Mithrax armatus* of De Saussure, and the *Mithraculus coronatus* of White and Stimpson.

De Saussure's description is not accessible to me, and the only mention I have of the species is in Stimpson's Crust. and Echi. Pac. Shores N. A., where the reference is given, and the locality (Mazatlan) of the specimen in the Mus. Phil. Acad.

Mithraculus coronatus finds a place in the "Catalogue of Crustacea from the Isthmus of Panama, collected by J. A. McNeil," by T. Hale Streets, but that author does not state from which side of the Isthmus his specimens came. I find the same species in S. I. Smith's "Brazilian Crustacea," from which I infer that it is not unlikely McNeil's specimens were from Aspinwall.

Dana says of *Mithrax:* "*Articulus antennarum externorum 1mus apice externo, duabus spinis longis armatus,*" but the antennal spines in *M. dichotomus* of the Mediterranean are very short, as they are in the present form. *Mithraculus,* however, is stated by Dana to be without long antennal spines.

As the antennal spines in this species are evident, but are rather teeth or lobes than spines, I assume that I have before me either De Saussure's *Mithrax armatus* or a new species—most probably the latter, more especially as, besides the doubtful locality, the proportions of the carapax given by S. I. Smith for his specimens of *Mithraculus coronatus,* do not agree with the present species, which has the length and breadth more nearly equal. I subjoin a short description:

Carapax almost orbicular, slightly wider than long; front four-lobed, the pre-orbital teeth projecting almost level with the two central lobes which constitute the rostrum. Fixed joint of outer antennæ with two obtuse teeth on its outer apex. Antero-lateral margin with five teeth, including the post-orbital, third tooth largest.

Regions of carapax very distinct and subdivided into areolets answering to those of the Xanthinæ and Chlorodinæ; areolets with punctate surface, without spines or teeth, and almost free from hair. Merus and carpus of first pair with spinose tubercles, hand smooth, cristate above. Those of female similar but smaller. Posterior feet beset with spines on their exposed surfaces, and densely pilose.

	♂ M. M.	♀ M. M.
Length of carapax	16	13
Breadth of ditto	18.5	15

Localities—Port Escondido, San José Island, Gulf of California. Found at low tide under stones and coral. Color, in spirits, light red.

If this species should prove to be new, I propose to name it *Mithrax areolatus.* The females, when collected in the month of August, were loaded with ova.

No. 13. Male and female, in spirits. Gulf of California. Fisher and Lockington.

Fisheria. nov. ger.

Carapax orbiculo-ovate, depressed, with short preorbital and post-orbital spines. First joint of outer antennæ wide, terminating outwardly in a long spine, which is followed by three others, which form the inferior margin of the orbit. Chelipeds of male, $2\frac{1}{2}$ times the length of carapax; those of female shorter than the second pair. Fingers serrate, obtuse and imperfectly spoon-shaped at tip.

This genus is evidently nearly allied to *Mithrax*, but the great length of the first and second pairs of limbs in the male, as compared with the carapax, and the row of teeth on the external margin of the fixed antennal joint, appear to necessitate its separation. The general aspect of the single species here described is totally different from that of *M. dichotomus* or *M. asper*, which are the only two species I have seen figured.

22. *Fisheria depressa.*

Male—Carapax depressed, widely pyriform, the regions marked by slight elevations granulated on the summit, the margins and spaces between the elevations somewhat tomentose. Rostrum bifid, short, reaching to the centre of the terminal joint at base of outer antennæ. A long spine at the external angle of the fixed joint of outer antennæ, succeeded by three smaller spines. Movable base of outer antennæ as long as flagellum, second joint largest, second and third joints slender, cylindrical.

Upper surface of carapax almost spineless, margins and orbits spinous. Orbit with two teeth above and four acute spines below, the two anterior of which belong to the fixed joint of antennæ. A row of teeth on the hepatic region, continued outwards from the maxillipeds.

Chelipeds of male enormously long, ischium produced into an acute spine on its anterior border; meros rounded, as long as post-rostral portion of carapax, beset with acute spines on its upper surface; carpus short, tuberculated: manus slightly longer than entire length of carapax (measuring to the end of the fixed finger); entirely smooth, compressed and broad, with rounded upper and lower edges; dactyli gaping, their obtuse ends imperfectly spoon-shaped and serrated, movable finger with a tubercle at half its length on inner border. Second pair $1\frac{1}{2}$ times as long as carapax, meros similar to that of first pair, with a row of about ten long spines on its upper surface, and a single spine on the distal extremity of its lower; carpus with a few spines; propodus very slender, entirely unarmed. Three hinder pairs similar to second pair, all with a single spine at distal end of underside of meros. Four hinder pairs sparsely hirsute above.

	M. M.
Length of carapax	27
Width of ditto	24
Length of first pair	68
Length of manus of ditto	33
Length of second pair	42
Length of fifth pair	33

These measurements are taken from the largest of six male specimens from Port Escondido, Lower California.

Female—Carapax as in male. Chelipeds shorter than second pair, fingers less widely gaping, no tooth on movable finger. In other respects as in male.

	M. M.
Length of carapax	21
Width of ditto	18
Length of first pair	24
Length of second pair	29

These dimensions are taken from the largest of eight specimens from Port Escondido and San José Island, Gulf of California.

Color, in spirits, bright red, the smooth manus, undersides of legs, and buccal apparatus especially bright.

No. 21. Male and female, in spirits. Fisher and Lockington.

23. *Mithraculus triangulatus.* nov. sp.

Carapax as broad as long; in form an acute isosceles triangle truncated in front; regions prominent, antero-lateral margin with three lobes. Rostrum very short, bifid, scarcely projecting beyond the line of the fixed joint of the outer antennæ, which terminates in a blunt tooth, followed by a second tooth or rather lobe, forming part of the lower margin of the orbit. Outer antennæ ciliate, movable basal joints cylindrical, short; second joint considerably stouter than the third. Lower margin of orbit formed by the teeth belonging to the fixed antennal joint, followed by a small tooth intervening between them and the post-orbital. Pre-orbital tooth scarcely evident, forming the obtuse termination of the elevated orbital region.

Chelipeds stout, longer than the second pair by almost the length of the hand, arm tubercular above, hand and carpus smooth, the former broad and heavy, stouter than the arm; dactyli obtuse and spoon-shaped at end, the movable one with a single tubercle on the inner margin.

Hinder limbs tubercular on upper surface; carapax and chelipeds without tomentosity, but a few hairs scattered on the hinder limbs. Females much smaller than males; the chelipeds small, about equal in length to the second pair.

Locality—Gulf of California.

	♂ M. M.	♀ M. M.
Length of carapax	16	13.5
Length of first pair	27	11.5
Length of second pair	15	12
Width of carapax across the posterior portion, where widest	14	12

The areolets of the carapax are prominent, but without spines; but the two largest posterior lobes of the antero-lateral margin are tubercular, and there are a few small tubercles on each postero-lateral margin.

Color, in spirits, uniform reddish.

No. 15. Several specimens, both sexes, in spirits. Fisher and Lockington

24. *Mithraculus coronatus.* Stimpson. Amer. Jour. Sci., second ser., XXIX, 1860, p. 132; Am. Lyc. Nat. Hist., New York, VII, p. 186; White (?), List. Crust. Brit. Mus., p. 7; T. Hale Streets, Proc. Acad. Nat. Sci., Phil., Dec. 5, 1871, p. 239.

This species is mentioned by Hale Streets in his "Catalogue of Crustacea from the Isthmus of Panama, collected by J. A. McNeil," but that author does not state whether the specimens were from the Pacific or Atlantic shore of the Isthmus. It is found at Aspinwall and along the Brazilian coast.

TYCHIDÆ.

25. *Tyche brevipostris.* Nov. sp.

Carapax an elongated rectangle with sinuate sides; rostrum short, depressed; laminate; pre-orbital spine long, elevated, produced almost as far forwards as the rostrum when viewed from above. A thin broad lobe behind the pre-orbital spine, concealing the elongated eyes except at the tip. Fixed joint of outer antennæ narrow, and boldly relieved from the surrounding parts, second and third joints cylindrical. Peduncles of eyes inserted level with the fixed joint of antennæ. Anterior portion of carapax bent downwards, posterior portion shield-shaped, the lateral and posterior margins overhanging, the latter thin. First pair of limbs shorter than second, scarcely projecting beyond the carapax. Second pair about as long as carapax, slender; succeeding pairs similar.

	M. M.
Length of carapax	17
Width of ditto	11

A single female specimen from Port Escondido, Gulf of California.

The general aspect of this little crab is that of a dried leaf; the anterior portion, deflected and somewhat pilose, does not attract the eye, while the shield-shaped posterior portion is very conspicuous. From the central tubercle of the gastric region, which is the most elevated portion of the carapax, a ridge is continued outwards on each side to the margin of the carapax, the surface of which is increased by expansions with sinuate edges. The whole of this leaf-like posterior surface is inclined in the opposite direction to the frontal portion. The pre-orbital spines project like a pair of horns immediately in front of the eye-shields, each of which is an obtuse isosceles triangle with its apex directed laterally.

As the specimen is a female it is impossible to be certain whether the small chelipeds are characteristic of the species, or of the sex only. I have placed this species in the genus *Tyche* of Bell, with which it has the following characters in common: Eyes without orbits, hiding below the carapax, which is oblong, wide in front and broad across the orbits, depressed, without post-orbital spines, and with pre-orbital spines produced to a line with the rostrum; first joint of external antennæ long, unarmed.

This form differs, however, from the generic description as given by Dana, in the shortness of the rostrum, which is bent downwards, but not more so than the anterior portion of the carapax.

EURYPODIDÆ.

26. *Oregonia gracilis.* Dana. U. S. Ex. Exp., I, 106, pl. III, f. 2. Stimpson, Crust and Echi. Pac. S. N. A., 16.

27. *Oregonia hirta*. Dana. U. S. Ex. Exp., I, 107, pl. III, f. 3. Stimpson. Crust. and Echi. Pac. S. N. A.

Both the *Oregoniæ* are found in deep water. Locality, Puget Sound. I have not seen either of these species.

28. *Leptopodia debilis*. S. I. Smith. Rep. Peabody Acad. Sci., 1869. Panama, Pearl Islands.

A single specimen of this species was found in Mr. Fisher's collection, from the Gulf Coast of Lower California.

29. *Inachoides (Microrhynchus) Hemphillii*. Lockington. Proc. Cal. Acad. Sci., February 7, 1876.

I have been in some doubt whether to refer this species to *Inachoides* or *Microrhynchus*, but as the eyes are tolerably elongated and do not appear to be retractile within the small orbits, I prefer the former. On the other hand, it differs from both genera in the absence of a post-orbital spine, unless a single spine on the antero-lateral margin, situated almost the length of the rostrum behind the eyes, can have a right to that name. The rostrum is one-fourth the length of the posterior portion of the carapax. The want of a post-orbital spine scarcely warrants the establishment of a new genus, but the definition of the genus *Inachoides* must, to admit it, be altered slightly, thus—

Inachoides. Edwds and Lucas. *Carapax valde gibbosus rostro longiusculo, acuto, spina post-orbitali parva aut nulla. Pedes* 8, *postici sat longi, gracillimi. Articulus antennarum externarum Imus angustus.*

The words *aut nulla* admit the present species. Localities—San Diego, San Luis Obispo, both in Upper California; La Paz, where it has been dredged from a bottom of sand and mud; San José Island; Amortiguado Bay; Port Escondido; Mulege Bay– all in the Gulf of California. The largest specimen I have seen, a male, exceeds in size the type in the possession of the Academy. The dimensions are as follows:

	M. M.
Length of carapax, including rostrum	34
Greatest width of ditto	13
Length of first pair	40
Length of second pair	70

One of the largest females measures 15 M. M. in length and 8 in width. The carapax of this species is free from the parasitic growth, often so abundant on maioid crabs.

No. 2. Male, San Diego, 7 fms. Hy. Hemphill.

30. *Inachoides brevirostrum*. nov. sp.

Carapax pyriform, the regions in the central line of the body more elevated than the lateral regions. Rostrum short, simple, consisting of the spinous termination of the septum dividing the fossettes of the inner antennæ. Opposite the anterior extremity of each fossette an acute tooth, so that the ros-

trum is somewhat trifid. Eyes long, not retractile. A small pre-orbital spine. Fixed joint of external antennæ prolonged externally into a short but acute spine; movable joints not concealed under the rostrum. First pair of feet shorter than the second in the male, than the third in the female; slender, cylindrical, the dactyli straight, in contact throughout their whole length, and almost equal in length to the manus. Four hinder pairs slender, cylindrical, the second rather more than 1⅔ times the entire length of the carapax. Carapax and abdomen tomentose, chelipeds tomentose, four hinder pairs ciliate, sides of rostrum ditto. Locality, Magdalena Bay, L. C.; dredged at a depth of three fathoms. Four females and one male.

	♂ M. M.
Length of carapax	9.5
Width of ditto	6.

The females are wider in proportion than the males. Notwithstanding the comparative shortness of the rostrum, and also of the carapax, the characters of the eyes and antennæ prove this species to be an *Inachoides*.

PERICERIDÆ.

PERICERINÆ.

31. *Pugettia gracilis*. Dana. U. S. Ex. Exp., I, 117, pl. IV, f. 3. Stimpson. Crust. and Echi. Pac. S. N. A., 16.

Localities—Puget Sound, Vancouver's Island; Mutiny Bay, Alaska; San Luis Obispo.

No. —. Male, in spirits, Vancouver's Island.

No. 19. Female, in spirits, Mutiny Bay, Alaska. Presented by Alaska Commercial Company.

32. *Pugettia Richii*. Dana. U. S. Ex. Exp., I, 117, pl. IV, f. 4. Stimpson. Crust. and Echi. Pac. S. N. A., 17.

The only locality at present certainly known for this crustacean is San Diego. Dana says of his specimen, "From California."

No. 9. Several dried specimens from San Diego. Henry Hemphill.

33. *Pellinia longioculis*. nov. sp.

Posterior portion of carapax broadly triangular, post-orbital spine expanded, trans-orbital width rather less than half the greatest width; rostrum short, stout, bifid. Stomachal region prominent. Fixed joint of external antennæ emarginate at apex, the outer tooth acute, not longer than the inner. Peduncles of eyes about equal in length to the distance between the eyes. First pair of feet about equal in length to the second and to the length of the body; meros tuberculate; hand thin, broad, smooth, marbled; fingers touching at the extreme tip only; a tooth on the inside of the movable finger near its base.

Four hinder pairs short, slender, cylindrical, setose, except the tarsus, which is smooth and shining, like the manus of the first pair. Carapax and abdomen tomentose above and below. A single specimen, male, found among a number of another species from different localities, so that its locality is uncertain, further than that it is from Lower California. Length and breadth nearly equal, about eight millimetres.

This species differs from *Peltinia*, Dana, in the length of the eyes. The antennæ are not hidden by the rostrum, so that it is impossible to place it among the *Epialtinæ*. It appears to me to be in its characters intermediate between *Acanthonyx* and *Epialtus*, and therefore should find a place in *Peltinia*, but to accommodate it the character, "*Eyes not retractile, short,*" must be changed to "*Eyes not retractile, of variable length.*"

EPIALTINÆ.

34. *Epialtus productus*. Randall. J. A. N. S. Phil., VIII, 110. Gibbes. Proc. Am. Asso., 1850, p. 173. Dana. U. S. Ex. Exp., I, 133, pl. VI, f. 2.

The figure in Dana's work represents the female, which differs so much from the male that it might easily be mistaken for a distinct species. The largest specimen in this collection is a male from Santa Rosa Island, Cal., collected and presented by W. G. W. Harford. This specimen displays well the differences between the sexes. It is armed with a large pair of chelipeds, the hand and fingers of which equal in length the breadth of the carapax. The four hinder pairs of legs are long and slender, and the carapax in all its dimensions greatly exceeds that of the female.

No. 4. Male, fine specimen, dried. Santa Barbara. W. G. W. Harford.
No. 5. Female, dried. Donor unknown.

35. *Epialtus Nuttallii*. Randall. *loc. cit.*, VIII, 109, pl. III. Gibbes. *loc. cit*, p. 173.

It is rather strange that this crustacean should not have found its way into our collection. Randall gives "Upper California" as its locality.

36. *Epialtus minimus*. Lockington. nov. sp.

Rostrum larger than usual in the genus, the emarginated extremities divergent. Trans-orbital width small. No pre-orbital or post-orbital spine. Antero-lateral margin with two triangular teeth, the anterior much the largest, their front margin at right angles to the carapax. Without the anterior of the teeth, the form of the carapax would be triangular. Distance from the anterior line of the first teeth to tip of rostrum about equal to the posterior portion of the carapax. First pair of feet in the male longer than the second, fingers obtuse and imperfectly spoon-shaped at their tips. Eight posterior feet slender, cylindrical, naked, except terminal joint, which is fringed below with short setae. Penultimate joint with one or two small spines on

the under side. Localities—Port Escondido, San Jose Island, both in the Gulf of California. Found at low tide under stones and in coral.

	♂	♀
	M. M.	M. M.
Length of carapax	14	14
Width of ditto	11	12
Length of first pair	18	..

The carapax of the largest female is stouter and broader than that of the largest male, but the latter more than makes up for this deficiency by the extra length of his chelipeds. In some of the females the manus is tuberculated, but is smooth in the males and in other females.

No. 17. Male and female, in spirits. Fisher and Lockington.

PARTHENOPIDÆ.

37. *Parthenope* (*Lambrus*) *punctatissima*. Owen. Zool. Beechey's Voyage, 81, pl XXIV, f. 4. Stimpson. Crust. and Echi. Pac. S. N. A., 18.

38. *Lambrus frons-acutis*. Lockington. Proc. Cal. Acad. Sci., Feb. 7th, 1876.

From Boca de Los Piedras, Sinaloa, Mr. W. J. Fisher brought two small specimens.

No. 8. Santa Catalina Island. Hy. Hemphill (dried).

39. *Cryptopodia occidentalis*. Dana. Am. Jour. Sci., 2d ser., XVIII, 430. Gibbes. Proc. Elliott Soc. Nat. Hist., Charleston, S. C. Stimpson. Crust. and Echi. Pac. S. N. A., 18.

Dr. Kellogg read the following paper:

Ludwigia Scabriuscula.

BY DR. A. KELLOGG.

Stem annual, erect, branching from the base, somewhat scabrous throughout, slightly decurrent-angled; leaves opposite—upper small (½-inch long; one or more lines wide), sessile, oblong-linear acute; base subclasping margin entire, or obsoletely toothed and scabrulose; flowers axillary, sessile or subsessile, solitary or clustered—six to nine or more in a whorl involving the stem; petals whitish, obovate-cuneate; claw short, nearly as long as the capsule—two to three times the calyx; stigma, four-lobed and capitate, style twice longer than calyx; capsules, ovoid, subquadrangular, angles slightly marked (eight-angled chiefly near the truncate apex; the four intermediate angles often processed into obsolete secondary teeth). Seeds obovate, minutely roughened and very obtusely striate; reddish brown. Muddy margins of streams and lakes; spicate fruited throughout main stem and branches. The lower leaves are wanting in several collections; intramarginal veins exceedingly obscure in the upper lesser leaves.

W. N. Lockington read the following:

Remarks upon the various Fishes known as Rock Cod.

BY W. N. LOCKINGTON.

Probably the most abundant fish in our markets are those known as rock cod. At least seventeen species are thus called, eleven of them belonging to Cuvier's genus *Sebastes*, four to *Chiropsis*, and those others to as many separate genera.

In 1854, and the subsequent years, as will be found by reference to the first volume of the "Proceedings of the California Academy of Sciences," the distinguished icthyologist, W. B. Ayres, described eight species of *Sebastes*, besides a large number of other fishes—about sixty-eight in all. Of the eleven species of *Sebastes* described by Ayres and Girard, we have within these last two months found in the markets all but three, viz: *S. nigrocructus*, Ayres; *S. elongatus*, Ayres; and *S. ovalis*, Ayres. The first of these, distinguished by several black bands across its body, is well known to the fishermen; of the second, which is characterized by its elongated body and light yellowish brown color, with blackish brown spots, the Academy possesses a specimen; but I have not yet seen the third, and Dr. Ayres himself states that it is rare.

S. ruber. Ayres. This species attains a large size and a weight of from ten to twelve pounds. It is of an almost uniform bright red, with a great abundance of small accessory scales on the large ones.

S. helvomaculatus. Ayres. This rosy-tinted fish may readily be distinguished from *S. ruber* and *S. rosaceus*, not only by its much smaller dimensions, but also by the row of three bright pink spots which adorn each flank. It does not appear to exceed a foot in length. In the month of June it was frequently brought into our markets.

S. rosaceus. Girard. About this species there is still some ambiguity, and it is not unlikely that two distinct forms are confounded under this name. The name was first applied by Girard to a large species of *Sebastes* figured in the P. R. R. Rep., vol. x, pl. xxii, and incorrectly supposed by that naturalist to be the same with the *S. ruber* of Ayres. Girard's figure is in many respects faulty, and in his description he refers to an error in the form of the caudal fin, which is drawn rounded, while in the fish it is sub-concave. The outline figure given by Ayres at Pro. Cal. Acad., vol. ii, fig. 62, is more correct, but Ayres gives no description. As I have lately had the advantage of handling several specimens, I think it may be well to notice a few particulars, some of which are not mentioned by Girard. The ventral fins are long and pointed, nearly equaling the pectorals, and extending beyond the vent; the pectorals also are long and pointed, the longest rays extending to within four scales of

a perpendicular drawn from the first anal spine; and the rays of both these pairs of fins are slim and delicate.

The second spine of the anal fin is stoutest, but is shorter than the third; the first soft rays of the anal are very long, much exceeding the posterior rays, and extending to the origin of the exterior rays of the caudal; and the caudal fin is most distinctly sub-concave, with the line of the outer fin rays continued forward as a ridge for some distance along the caudal peduncle. The two lower spines of the pre-operculum are more developed than in Girard's plate, and the spinous dorsal is more correctly shown in Ayres' outline figure. Ayres has, however, omitted the characteristic broad short spine situated directly over the centre of the maxillary.

Girard gives his *S. rosaceus* "two pairs of small and horizontal spines" upon the upper surface of the head. The specimens we examined were provided with five pairs of spines, none of them very conspicuous. There are two long, low, orcipital spines, between which and the eyes are three pairs of very small spines; a fourth pair (supra-orbitals) occurs, on the extreme edge of the upper margin of the orbit, above the pupil; the space between the eyes is unarmed, and the fifth pair is situated between the nostrils.

Girard gives the color as "a uniform reddish or crimson tint, lighter beneath than above," characters which agree with *S. ruber*. *S. rosaceus* is far from uniform in tint when fresh, the upper portion of the head and back being extensively blotched with a darker red than the ground tint, inclining to brown. In view of all these differences, I think it not improbable that Girard's figure may be that of another species which I have not yet seen, in which case Ayres' species would no longer be *rosaceus*, and might fitly be named *S. Ayresii*. I may here mention that I have had a large specimen brought to me from deep water, and presenting several differences from the typical *S. rosaceus*, but, as it is deformed about the jaws and dorsal fins, I think it best at present to include it under that species.

S. nebulosus, Ayres, is a tolerably common fish in our markets, and is perhaps one of the most beautiful of this gorgeously colored genus of fishes, adorned as it is with yellow bands and blotches upon a dark, almost black, ground. The largest specimen in the collection of the Academy is eleven inches long, but has a girt of nine inches and a half; this species being one of the stoutest and deepest of the genus. I subjoin measurements of another specimen which came into our hands:

	Inches.
Length	11
Length of head	3
Girth in thickest part	10.2
Length of spinous dorsal	4
Length of caudal fin	2
Length of pectorals	2.5

S. paucispirus. Girard. This is one of the most singular fishes of the genus, its lower jaw reaching forward and upward so much that the tip of the mandible continues around the cone of the dorsal outline. This species is far

from common. Following are the dimensions of a specimen recently presented to the Academy:

	Inches.
Total length	5.3
Length of head	4.8
Length of spinous dorsal	4.5
Length of caudal	3
Length of ventrals	3
Length of lower jaw	3.5
Girth in thickest part	3.7
Diameter of eye	1

S. melanops. Girard. In the month of June this species was abundant in the markets. It is a sober-colored fish, attired in black and gray, the black in varying proportions upon the lighter ground; and in size it is usually superior to *S. ruber* and *S. rosaceus*.

S. flavidus. Ayres. This species is not so uncommon as Ayres believed it to be when he described it. During June of this year it was nearly as abundant as *S. helvomaculatus*, *S. melanops*, or *S. auriculatus*, and more so than either species of *Sebastes*. It is readily distinguished by the greenish brown and yellowish green tints of the back and sides, as well as by the third spine of the anal fin, which is longer than the second, instead of about equal to it, as in *S. melanops*, which is a closely allied form. The largest specimen seen by us measured as follows:

	Inches.
Total length	15.5
Length of head	4.2
Length of spinous dorsal	4.2
Length of caudal	3
Girth in thickest part	10
Diameter of eye	1

S. auriculatus. Girard. This fish can always be distinguished by a black mark upon each of the gill-covers, very obvious in the younger fish, and sufficiently distinct, though less clearly outlined, in older specimens. The general color is a dull reddish brown, with cloudings, of a darker tint upon the back and sides; these cloudings, like the black spot before mentioned, becoming more diffused and indistinct with increasing size and age. This appears to be the only species of *Sebastes* which frequents the Oakland side of the bay, where it is very commonly taken with hook and line from the railway wharf. The bay upon the Oakland side is less saline than at San Francisco, the influx of the tide damming up the fresh waters of the Sacramento and other smaller rivers and creeks, and throwing them toward the main-land. Many of the marine fishes, therefore, do not visit this side, while salmon are frequently taken there. A large *S. auriculatus* measured as follows:

	Inches.
Length	16.5
Depth at origin of first dorsal	4.7
Length of dorsal	8.5
Length of head	4.3

Anarhichthys felis. Girard. This rapacious fish, a near relative of the wolf-fish of the Atlantic, attains a large size. One obtained recently in the market measured four feet nine and a half inches from snout to tip of caudal fin, and one of larger dimensions was received by the Academy last year, but was lost for want of a vessel sufficiently large to contain it in spirits. The specimen described by Girard was only fifteen inches long. Some few weeks ago I saw in the papers an item detailing how some one in the north of this State had found an "infant sea-serpent" seven feet long, with a long fin on the back and another below, both reaching to the tail, a conical head and large teeth, etc. The description was, in fact, a tolerably correct one of a specimen of this fish of about the size of that sent to the Academy. It is not very common, but is occasionally brought to market, and is eaten by the Chinese.

Regular Meeting, August 7th, 1876.

Dr. A. B. Stout in the Chair.

Sixty members present.

Donations to the Museum: From Capt. H. Johnson, ovary of viviparous perch, larva of *Prionus Californicus*. From J. P. Dameron, specimen of *Gillichthys mirabilis*. From Wm. J. Fisher, specimens of *Conorhynchus, sphyræna, argentea, Tetraodon polita, Mustelus Californicus, Trachynotus ovatus, Paralabrax nebulifer, Sasmicossiphus pulcher, Argyreiosus Pacificus, Gelasimus princeps, Grapsus strigosus*. From J. M. Middleton, five specimens of cinnabar from Sulphur Banks, Lake County. From Henry Edwards, one specimen of silver ore from Austin, Nevada, five specimens crystals of cinnabar from interior of chimney of furnace, Lake County. From Governor Wm. Holden, two specimens silver ore from Elko District, Nevada. From Mr. Glass, calc-spar and asbestos from Calaveras County. From A. J. Severance, two specimens of greenstone (diamond drill core), from Yuba County, and two specimens of silver ore

from Nye County, Nevada. From C. D. Gibbes, four specimens of coal from Australia, Nanaimo and Mt. Diablo.

W. N. Lockington read the following:

Notes on some California Marine Fishes, with Description of a New Species.

BY W. N. LOCKINGTON.

Mr. W. J. Fisher, formerly Librarian of this institution, is now engaged in collecting objects of Natural History on the coast of Lower California. I have up to this period received two consignments from him, consisting of skins of birds and mammals, shells, crustacea, and a few reptiles and radiates.

As the Academy kindly assisted us by furnishing alcohol, and as we wish to do our best to make the collection in this building a complete one as regards Californian species, we shall from time to time, as we are able to identify and describe them, present specimens of such forms as are not in its possession.

The work of identifying is necessarily slow, and our time limited. It is intended for the future to furnish notes with the specimens presented—fishes, crustacea, etc. Our time has hitherto been occupied entirely with the fishes and crustacea.

Among the former are two or three forms which I believe to be new, and several others which are not brought into our markets, although they have been described by Ayres or Girard, and range as far north as San Francisco Bay.

We present this evening specimens of such of these as we have been able to identify or describe, and the greater part of these notes relates to the specimens presented.

Mr. W. G. W. Harford, who has assisted me greatly, has himself taken most of the measurements given in this paper.

Albula conorhynchus. Gunther.

Among the fishes forwarded to us, the only soft-finned ones were two beautiful specimens of about the size of a mackerel, glowing with gold upon the sides, and with darker metallic reflections upon the back, the prevailing tint, however, especially below, being that of burnished silver.

I should have believed them to be fresh water fish had I not known that everything from the waters yet sent by Mr. Fisher was marine. Unfortunately the label attached was so injured by the alcohol that it was lost in unpacking.

The structure of the teeth, however, proved the fish to be no cyprinoid, and the absence of an adipose fin "counted out" the salmon and other families. One of the clupeoid or herring family, therefore, it must be, both by its structure and its marine habitat. Yet it seemed a very singular herring, with its rounded abdomen (the herrings mostly have a sharp abdomen)

and the curious yellow gelatinous membrane, which covered the eyes so as to leave no outward trace of the orbit.

On examining the genera and species of clupeoids given in Dr. Gunther's valuable catalogue, I found, however, one species, the only one of its genus, and this the only one of its tribe, characterized, among other things, by a flat abdomen (which I take to mean not sharp as in the rest of the family), and an "adipose membrane covering the eye." I therefore concluded that my fish was an example of that singular species, and my belief was strengthened by the close agreement of all the other characters, as the number of fin rays, position of mouth, teeth, etc.

The only difference I noted was in the color, which Gunther gives as "uniform silvery," but it must be remembered that these specimens were much fresher than Gunther's could be; and the much greater prevalence of the gold and dark metallic reflections in one of the specimens than in the other, appears to show that the tints are variable. This point I hope to settle ere long, by the aid of Mr. Fisher.

Following are the dimensions of one of the specimens:

	Inches.
Length	3.7
Length of head	3.5
Length of base of dorsal	2.5
Tip of snout to origin of dorsal	6.
Length of caudal	3.
Tip of snout to base of anal	8.
Girt in thickest part, just in advance of dorsal	7.

This species has been found in the Atlantic and Indian Oceans, and one of Gunther's specimens was from the Pacific Coast of Central America, but I do not find that it has previously been reported from the North Pacific.

Argyreiosus Pacificus, n. sp.

Greatest height of dorsal outline, immediately behind the eye; greatest depth of body, immediately in front of anal. Proportion of length to greatest depth, about as 7 to 15. Lower jaw longer than upper. None of the rays of spinous dorsal elongated. First three rays of soft-dorsal very long, next two decreasing, the remainder nearly equal. No free spines in part of anal. First articulated ray of anal much elongated. First three rays of soft-dorsal undivided, the others much branched. Membrane between rays of anal very short, rays much branched, except the first, so that the anal appears to consist of many finlets, especially when depressed. Dentition and brancheostegals, normal. Pectorals very long, one-third the total length of the fish. Fourth, fifth and sixth rays (counting downwards) the longest. Ventrals very short and small. Dorsal outline depressed behind snout, then nearly perpendicular to above posterior edge of orbit, thence almost straight to origin of soft dorsal, thence rounded and rapidly narrowing to peduncle of tail. Caudal lobes very long and narrow. The greatest thickness of the fish is between the eyes and the base of the pectorals. Formula of fins: D, 4 or 5, $\frac{1}{23}$; A. $\frac{1}{19}$; P. $\frac{1}{18}$; V. $\frac{1}{5}$.

Numerous specimens of this species caught in Magdalena Bay have been examined by us, and careful comparison with the forms described in Gunther's catalogue has led me to the conclusion that this is a new species. From *A. vomer* it differs in the extreme shortness of its ventrals, none of the rays of which, or of the spinous dorsal, are continued into filiform prolongations; also, in the greater proportional length of the pectorals. From *A. setapinnis* it can be at once distinguished by the prolongation of the first rays of the soft dorsal and the anal.

The dimensions of a large specimen are as follows:

	Inches.
Extreme length in straight line from the tip of lower jaw to tip of lower lobe of tail	15.5
Extreme height in front of anal fin	7.2
Height immediately behind eye	6.65
Greatest girth	14.60
Length along profile from tip of lower jaw to origin of soft dorsal	10.60
Length from tip of lower jaw to origin of anal	6.75
Length of base of soft dorsal	5.60
Length of base of anal	5.50
Length of base of pectorals	.62
Length of head above orbit	3
Length of pectorals	5.45
Length of ventrals	.5
Length of caudal to division of lobes	2.25
Length of lower lobe of caudal from fork	3.40
Length of upper lobe of caudal from fork	2.95
Length of longest ray of dorsal	4.10
Length of longest ray of anal	3
Length of lower jaw	1.8
Distance from tip of lower jaw to orbit	2.65
Diameter of orbit	.75
Greatest thickness of fish	1

One or two specimens exceeded these dimensions.

Cestracion francisi. Grd. U. S. P. R. R. Rep., vol. x, p. 365.

Of this genus of sharks, so interesting from its occurrence in geological time as far back as the Devonian Age, only four species now exist; one of these, *C. phillipi*, is the often-mentioned Port Jackson shark; another, *C. francisi*, has been caught in the Bay of Monterey, and occurs along the coast at least as far south as Magdalena Bay, Lower California, from which place we received a single fine specimen, the dimensions of which are appended:

	Ft.	*In.*
Length from tip of snout to tip of caudal	2	6½
Length from tip of snout to origin of first dorsal		8⅞
Length from origin of first dorsal to origin of second dorsal		8½
Circumference immediately in front of first gill-opening	1	1¼
Circumference immediately in front of pectorals	1	1¾

Circumference immediately behind first dorsal		11
Circumference immediately in front of second dorsal		6⅛
Distance from tip of snout to eye		2¾
Longitudinal diameter of eye		⅝
Breadth between supra-ocular ridges		2¼
From spiracle to tip of snout		3¼
Length of pectorals along anterior edge		7
Height of first dorsal spine		2⅛
Length of base of first dorsal		2
Length of base of second dorsal		2½
Length of claspers from opening of anus		4⅛
From anus to tip of snout	1	1¾
Width between angles of mouth		3¼

Trachynotus ovatus? Gunther.

Among our fish were several specimens which appeared to agree in every respect with Girard's genus *Doliodon* (*Trachynotus*, Gunther), and to be very near the species named by him *Doliodon carolinensis*. A comparison of proportionate dimensions, however, induces me to consider it as belonging to the long-known species *T. ovatus*, which has previously been found in almost every sea from the east coast of North America to the shores of Australia. The dorsal spines are, one directed forward, six with membrane attached, and one at origin of soft dorsal. The principal measurements of the specimen presented are as follows:

	Inches.
Extreme length	11.62
Extreme depth from dorsal to anal	5.12
From tip of upper jaw to tip of first dorsal spine, following outline	4.0
Thence to origin of soft dorsal	1.75
Length of base of soft dorsal	3.25
Length of vase of anal	3.0
Length of vase of pectorals	0.5
Length of pectorals	2.12
Length of ventrals	0.95
Greatest girth	10.62
Girth at base of pectorals	8.5
Length of head	2.75
From orbit to tip of upper jaw	0.55
Diameter of eye	0.60
Greatest thickness of body between eye and pectorals	1.25

One of the specimens was at least one-third larger in every dimension.

Paralabrax nebulifer. Grd. P. R. R. R., x, p. 33, pl. xii, fig. 1–4.

This species does not, so far as I know, occur near this vicinity, as I have not yet detected it in the market. We have several specimens from San Bar-

tolome Bay, Lower California, where they were taken among kelp. The largest specimen measures as follows:

	Ft.	In.
Extreme length	1	5¼
From snout to posterior edge of operculum		5¼
Base of dorsal fin		7¼
Base of spinous portion of fin		3¼
Circumference in front of pectorals		10¼
From snout to origin of dorsal		5¼
From snout to origin of anal		11
Length of pectorals		3¼
From snout to origin of pectorals		5$\frac{7}{10}$
Length of ventrals		3

Triacis semifasciata. Gnthr. (*Mustelus felis.* Ayres.)

This is one of the commonest sharks of San Francisco and Tomales bays, and is also found on the coast of Lower California. Ayres described it as a *Mustelus*, but its teeth, though somewhat pavement-like, and, in many cases, have points or cusps, whereas in *Mustelus* they are wholly smooth. Both this species and *Mustelus Californicus*, Gill, are commonly called "dog-fish," but, though from their small size, they resemble the real dog-fish or *Scylliadæ*, they differ from them greatly in their teeth, and in the absence of a nictitating membrane to the eye. A large specimen, procured in this bay, measured as follows:

	Ft.	In.
Tip of snout to end of tail	4	3
Tip of snout to origin of first dorsal	1	3
Origin of first dorsal to origin of second	1	4
Length of base of second dorsal		4.5
Greatest length of pectorals		8
Length of head on back		8
From anterior margin of lower lip to origin of anal	1	10
Snout to anterior margin of lower lip		3.25
Greatest circumference at origin of anterior dorsal	1	6

Mustelus Californicus. Gill.

This is the common "dog-fish" of San Francisco Bay. It does not usually attain the dimensions of the species last named, and is easily distinguished from that prettily marked species by its plain uniform slaty hue, becoming whitish beneath.

Semicossyphus pulcher. Gunther. (*Labrus pulcher.* Ayres.)

This fish was the first of the sixty-eight Californian species described by Dr. W. O. Ayres, and its description forms the first page of the first volume of the proceedings of this Academy. The smaller number of spinous rays in dorsal, the presence of a posterior canine tooth, and the absence of scales on

the pre-operculum, do not allow of its classification in the genus *Labrus*, and Dr. A. Gunther considers those peculiarities sufficiently marked to warrant the formation of a new genus for its reception. Fortunately for us, we have a very full series of specimens; had it not been for this, the extreme forms would certainly be considered distinct species. Not only the coloration, but the form of the head, varies greatly, but the variations will be found, on comparison of a number of specimens, to shade into each other, and the extreme forms are found along with each other among the floating kelp. Some of the specimens were taken at a depth of eight fathoms, but still near kelp. A label attached to a highly colored specimen gives the following particulars of the colors when fresh:

"Iris golden, with a red rim; head to pectorals black, including upper jaw; lower jaw white. Pectorals, ventrals, caudal and dorsal, black. Body from head to a perpendicular from behind anus, deep red, shading into light red under belly. From anus to end of caudal, black."

One of the largest specimens measured as follows:

	Ft.	*In.*
Total length	1	6
Base of dorsal fin		7.1
Height of soft dorsal		3.5
Length of spinous portion of dorsal		5
Length of base of anal		3.5
Height of anal		2.5
Length of base of ventral		1
Length of ventral		3
Greatest depth of body, at origin of soft dorsal		5.5
Greatest girth at origin of soft dorsal	1	1
Length of tail		3
End of snout to origin of dorsal, following the outline		6.5

Sphyræna argentea. Grd.

Of this rare species one large specimen and three smaller have been sent to us. The largest measured as follows:

	Ft.	*In.*
Extreme length	2	10.5
From tip of lower jaw to posterior edge of operculum		9
Base of first dorsal		2.6
Tip of lower jaw to origin of first dorsal	1	1.2
Base of second dorsal		2.6
Tip of lower jaw to origin of second dorsal	1	9.5
Length of tail		5.2
Girth in front of pectorals		8.4
Tip of lower jaw to anterior rim of orbit		4
Diameter of orbit		1.1

C. W. Kreuger was introduced by Mr. Troyer and delivered a lecture on "Flying Machines," exhibiting and explaining at the same time a model of a flying machine of his own invention.

Regular Meeting, August 20th, 1876.

Vice-President Hyde in the Chair.

In addition to the usual exchanges there were presented to the Library two volumes of the Annals of the Observatory of Madrid, and two volumes of Hayden's U. S. Geological Survey.

Dr. Kellogg read the following:

Notes and Descriptions of some Californian Plants.

BY DR. A. KELLOGG.

Dr. G. Eisen, of Sweden, placed in our hands for determination his plants collected near Fresno, Cal. A species of *mimulus* appears to be new.

Mimulus Eisenii. K.

Viscid-glandular chiefly above, somewhat pubescent throughout, ½–1 foot branching from the base, whole plant more or less purplish. Radicle and lower cauline leaves 1–2 inches long, on slender petioles; laminal outline ovate-oblong, oblong, or oblong-subspatulate, pinnatifid, rachis nerved, narrowing into the petiole, which from long becomes equal in the lower cauline, at length very short toward the summit, but all petiolate; lobes variably denticulate, somewhat hispid and cilliate, simply denticulate-pinnatifid in the upper reduced leaves; peduncles subsetiform as long as the flower; calyx colored, pinkish above, yellowish beneath dotted with large purple spots in lines chiefly on the upper side, at length becoming oblique ⅓–½ the peduncle; teeth somewhat triangular-acute, lower a little shorter or subequal in flower, 1–2 lines, carinately incurved, closing the throat toward maturity; upper tooth elongating to apparently twice the length of the lower or nearly half the length of the calyx upwardly curving; corolla yellow, a single lower lobe often white, about five lines or twice the calyx; tube slender, throat expanding, lobes about equal; capsule oblong, obtuse, narrowing at the base into a short stipe.

Also a *Vicia*, which appears to be new.

Vicia nana. K.

A very low (3–6 inches) and slender perennial, erect or ascending, flexuous, sub-four-angled, branching from the base, finely pubescent or nearly glabrous throughout; leaves short, about one inch, tendrils simple or rudimentary; leaflets one to three pairs (or more?), thin nerved, obovate or oval-elliptic, mucronate about half-inch long; stipules narrow lance-acuminate, entire, de-

flexed subulate lobe one-half to one-third shorter; peduncles 2–3 inches long, or about twice the length of the leaves (rarely equal), 3–6 flowered; flowers large, three-quarters to one inch long, calyx ten-nerved, obliquely tubular-campanulate; teeth shorter than the tube, two upper slightly shorter, banner, purple blue; the short wings and keel whitish; staminal sheath very oblique; stigma finely villous, a line or so on both sides; pod glabrous, one inch or more in length, flat linear-oblanceolate, narrowing to a short stipe; 12-14 seeded.

Mr. Samuel Brannan, Jr., placed in the Academy Herb. a new plant collected by him on the top of Granite Mount, Oak Creek, Kern County, April 1st, 1871.

Phacelia Brannani. K.

A low spreading annual, four inches to a span high, much branched from the base, densely minute canescent puberulent throughout, and viscid villous-glandular above; racemes scorpoid, becoming opposite the upper leaves; leaves oblong in outline—2–3 inches long, $\frac{1}{3}$–$\frac{3}{4}$ inch broad—petiole $\frac{1}{3}$–$\frac{1}{5}$ the length, bipinnate, lobes subsessile, few pinnatifid above, oblong, crenate and incisely-crenate toothed or subpinnatifid with roundish lobules of variable size and order; corolla open funnel form with a broad campanulate border; lobes rounded, bright blue, genitals included; filaments naked, somewhat infolded at the base; style shortly bifid, hirsute below; calyx lobes shorter than the tubes, spatulate-linear, about twice the length of the oval hirsute capsule; seeds oblong, compressed, centre depressed, the thickened margin transversely corrugated; about 12-seeded.

Lathyrus splendens. K.

Stem-climbing, perennial, quadrangular, somewhat striate, subpubescent, mostly glabrous, often glaucous; leaflets about eight, scattered, very variable, linear to lanceolate and ovate-lanceolate or oblong on the same specimens, acute, mucronate, strongly three to five-nerved and veined, reticulate, glabrous above, rarely subpubescent beneath, petiolules hirsute; common petioles about equal, subtrigonal, slightly channeled above or margined, puberulent, relatively stout, tendrils two to five-parted; stipules small, semi-saggitate and semi-lunate, upper longer lobe acuminate, subfalcate, entire, or rarely laciniate, notched or toothed, lower mostly repanddentate; peduncles stout, about equal, rarely becoming a little longer than the leaves, seven to ten-flowered, flowers very large, scarlet-purple, pedicels pubescent, two to three times the length of the calyx, articulated; calyx obliquely campanulate, pubescent, eighteen-nerved, upper teeth remote, very short, triangular-acute; the lateral, sublanced nearly twice as long as the upper, and a third less than the lower subulate tooth, which is about equal to the tube; banner about one inch in length and nearly as broad, emarginate, reflexed; keel an inch or more in length by half an inch in depth, acute or subacute; wings narrow, shorter; style clavate, somewhat flattened and folded, or grooved on the outside next to the keel, villous along the inside, one-third to one-half its length; pods three inches in length, glabrous, compressed, symmetrical, 10 to 20 seeded,

color cinnamon brown, inside of the valves silvery satiny; seeds about half the size of common pea, verditer-greenish hue; allied to *L. polymorphus*. A climbing vine, six to ten feet creeping over bushes, and, with its numerous branches and wealth of brilliantly gay scarlet-purple flowers, seen at a distance presents the illusion of a grand flowering shrub, naturally suggesting it as an appropriate accessory for such a purpose in ornamental and rural adornment.

Some specimens have altogether filiform or linear leaves, and filciform subulate entire stipules; some with brighter scarlet flowers, and others purple tints abound; but they are not deemed sufficiently uniform and distinct to entitle them to varieties. Specimens presented by J. M. Hutchings, Esq., from southern California.

Dr. Kellogg exhibited specimens and made some observations on a variety of *Collomia leptalea*, Gray, from Yosemite Valley. The specimens were far more delicate than the original type, in every respect, even like the finest sewing-thread; the most peculiar feature being the disposition to twine, as occasion offers, around contiguous weeds for support. The plants, four to five inches high, have flowers of similar form and relative relations, but sky *blue* instead of *pink;* anthers spheroidal; capsule three-seeded—seeds elliptic, somewhat prismatic, subglabrous, or a little rugose, and appendiculate; the whole plant stipilate-glandular, lower leaves opposite (one to two or more pairs) filiform. As we have but two specimens, we reserve a thorough analysis rather than destroy them. Its provisional distinction might well be *filiformis*.

Mr. F. P. McLean, our promising botanical friend—late of the California University, now Johns S. Hopkins University, Baltimore—on the eve of his departure placed in our hands a specimen of *Psoralea*, ticketed "Streams of Tamelpais, 1873," which appears to be new.

Psoralea fruticosa. K.

A low-spreading sub-shrub, more or less canescent-pubescent, with shortish white soft hair throughout; leaves digitately-trifoliate, slender petioles very short (1–2 lines long), appressed; stipules subulate, strongly nerved (3–4 lines long; leaflets cuneate, oblong-obovate, recurve-apiculate, mucronate (½ to ¾-inch long, 2–3 lines broad); terminal compound spikes sessile, 2–3 inches long; the branches (mostly simple) 1–2 inches long; flowers densely crowded (50–100 or more), very small (2–3 lines), indigo blue, subsessile, or pedicels barely ½-line; persistent bracts narrowly lanceolate-acuminate about as long as the flowers; calyx teeth ovate-acute, lower tooth about one-third longer, acuminate, banner sub-obcordate cuneate into the claw, wings about equal, keel shorter; legume glabrous, ovate-oblong, acute, wrinkled and roughened. Allied to *P. floribunda* and *obtusioloba*, but readily distinguished by denser branches, foliage and flowers, branching spikes, the full-sized leaves intermixed with the flowers of the base of the spikes, and also crowding them; longer and whiter pubescence, and very much shorter petioles and pedicels, and relatively far longer stipules, and bracts; also, difference of

legume, etc. But not so readily from *P. bracteata* of the Cape of Good Hope. The upper surface of the leaves become of a dark verdigris-green in drying, like *Petalostemon macrostachya* of Torr., but all parts of the flower are most perfectly separate and distinct from the staminal sheath, as in *Psoralea*.

We are indebted to Miss Anderson for the following Lake County Lupin:

Lupinus sericatus. K.

Stem woody at the base, ascending, low (½ to 1 foot), pubescence white, closely appressed, as if clad in a silvery satiny sheen throughout; leaves 3-5 inches long; leaflets spatulate, extremity broadly rounded obtuse (abrupt mucronation mostly obsolete), base narrowly cuneate, ⅓-½ the length of the petiole (or 1-1¼ inches); racemes twice the length of the leaves (about six inches long); flowers subverticillate or scattered, purple blue; pedicels rather stout, angled, rarely as long—often shorter—than the calyx; bracts deciduous; calyx campanulate, neither gibbous nor spurred, upper lip shortly two-toothed, the scarcely longer lower lip obsoletely three-toothed; bracteoles subulate, a line or more in length; banner somewhat short, slightly pubescent on the back; wings broad, naked; keel acute, a little cilliate; pods 3-5-seeded; mature legume not seen.

The description of *Psoralea macrostachya* in the recent State Botany should be amended so as to include characteristic coast forms. In this vicinity they are weakly scabrous with elevated glands, as in the description of T. and G.; leaflets rhombic-ovate, pubescent above and subglabrous beneath; peduncles ½-1 foot or more in length, or 2-6 times exceeding the leaves; pseudo-bracteoles of their base, sometimes developing into accessory leaves; spikes simple, or branched by twos and threes, the floral portion 2-8 inches long, cylindrical and dense, or scattered; bracts relatively broad (2 lines), or half the length of the calyx, rhombic, the abrupt acumination very short, early deciduous; calyx 4-6 lines long: lower tooth ⅓ to ½ longer, but shorter than the flowers.

Closely allied to *Phacelia cilliata*, Benth., is another form worthy of note, collected by the late Dr. Andrews:

Phacelia glandulosa. K.

Stem annual, a span or more high, with few branches at the top; hispid and stipitate-glandular, mostly throughout; leaves ovate-oblong, somewhat seven-lobed, irregularly sinuate-toothed, three-nerved, canescent-pubescent chiefly above, petioles equal, or of upper leaves shorter; spikes simple, axillary, leafy, terminal one naked, at length elongating into loose racemes, pedicels declined ascending in fruit, genitals much exserted from the blue rotate corolla; calyx lobes linear-spatulate hispid and stipitate-black glandular, and on the inside villous, ½ to ⅔ the length of the capsule; style deeply 2-parted, shorter than the bearded filaments; capsule ovate-oblong, acuminate, hispid and often glandular on the outer third, about 20-seeded; seeds triangular prismatic, minutely alveolar-pitted.

Among other observations, it is deemed important to place on record that the Hon. Vice-President, H. Edwards, presents to the Academy a naturalized

form of the true European *Bellis perennis*, found by him in Throckmorton's Cañon, growing in moist ground, near the foot of Mt. Tamelpais, in a perfectly wild state, remote from any habitation. It has been duly studied, and carefully analyzed, and is undoubtedly the plant indicated; of course, it only now sports a single series of white rays tinged at the tips with purple; is slightly reduced in size; the floret tubes proper are more hairy; stigmatic appendages not quite so broad, and rather more elongated, when compared with the cultivated plant; the first flowers are on true scapes, later flowers on very short or tufted stems; occasionally a leaf develops on the proper peduncle above the rosulate clustered foliage below.

Nemophila modesta. K.

Slender, weak and prostrate (1-1½ feet); leaves opposite pinnatifid, lobes 3–5, broadly lanceolate entire, sparsely hirsute above and along the veins beneath, subsessile, the narrowing base cilliate; peduncles axillary, hirsute, 3–4 inches long, or 3–5 times the leaves, erect but recurving near the capsule; calyx auriculate and increasing to age, lobes ovate, acute, hirsute; flowers large (6 to 8 lines), blue with deeper blue veins and purple spotted, hirsute within at the base, twice the length of calyx, naked (no scales, folds or ligules at the base of filaments); stamins 3 long and 2 shorter, base hirsute (anthers dark purple); style 2-parted above, hirsute below, stigmas capitate; capsules hairy, 6-seeded, seeds large and rough.

Found by Kellogg and McLean, near the Guadalupe Quicksilver Mine.

Dr. Eisen also collected specimens of a charming little annual Lupin:

Lupinus citrinus. K.

A low, slender annual, barely a span high, erect and ascending, branched from the base, hairy throughout; lower leaves long slender petioled (relatively shorter above, or from about three inches to less than an inch); leaflets linear-spatulate, attenuate at base, somewhat canaliculate, mucronate, 6–8, ½–¾-inch long, 1–2 lines wide, stipules adnate, somewhat membranous, lance-subulate, weakly attenuate, 4–6 lines long; main raceme 4–6 inches, those of the branches 3–4, rather closely flowered from near the base (common peduncle naked below about 1 inch); pedicels short and slender; bracts linear-lance-acuminate deciduous; calyx colored, short, upper lip 2-parted, lobes acute, or subacute, lower about equal, minutely 3-toothed, bracteoles minutely obscure or wanting; flowers bright orange or golden, rounded banner dotted with a few oblong pale bluish spots near the infolded centre; wings obtuse, nearly as broad as long; keel naked; creamy-hued pod, oblong-linear, 7-lines long by 1½ wide, torulose, glabrous, 4-seeded, seeds rhomboid, lenticular, black blotched at the germinal end and black spotted along the ridge of the beveled margin, on a leaden ground.

Owing to the very obtuse inflated wings conforming to the general outline and size of the banner, gives the flowers somewhat the appearance of beads of gold. A charming plant for cultivation.

Dr. Eisen also brings to light a new species of *Clarkia*.

Clarkia Eiseneana. K.

Stem glabrous and glaucous, 1–1½ feet high, erect, branching above; leaves ovate-lanceolate or ovate-oblong, acute or subacute, repand-denticulate, sessile, lowest leaves subsessile or very short petioled; petals entire, lamina rhombic on a long slender claw, toothed on one side at the insertion: alternate stamens perfect, a broad densely hairy scale at the base of these filaments in front or on the inside, stigma-lobes equal, the very slender linear capsule sessile, 2–3 times as long as the obpyramidal calyx tube, hirsute together with the calyx.

Camping with Mr. Galen Clarke, he brought in the following:

Potentilla Clarkiana. K.

Stem perennial, tufted or dwarfed, and depressed ¼–1½ inches, bearing a single pair of opposite rudimentary leaves, pubescence scanty, at length glabrous; leaves ternate, leaflets nearly orbicular 4–6 lines, coarsely 5–6-toothed (if simple, 7-toothed), terminal leaflets short petiolulate; bractlets half as long as the calyx lobes, subacute; petals yellow, shorter than the calyx; about one-flowered.

Regular Meeting, September 4th, 1876.

Dr. A. B. Stout in the Chair.

Twenty-two members present.

Wm. G. Kreuger and Thos. Murffen were proposed for membership.

Donations to the Museum: From Mr. W. P. Truesdell, tarantula and nest. From W. J. Fisher and Henry Edwards, specimens of Crustaceæ. Also, ten fish from Mr. Lockington.

W. N. Lockington read the following:

Remarks on the Crustacea of the West Coast of North America, with a Catalogue of the Species in the Museum of the California Academy of Sciences.

BY W. N. LOCKINGTON.

CANCROIDEA.

Family Cancridæ. Sub-Family Cancrinæ.

No new species of this sub-family appears to have been found since Stimpson described *Cancer antennarius.*

Cancer magister. Dana. U. S. Ex. Exp., I, 151, pl. VII, fig. 1. Stimpson, Crust. and Ech. Pac. S. N. A., 18; Proc. Cal. Acad. Sci., 1, 88. *Cancer irroratus.* Randall (not Say.) Lockington, Proc. Cal. Acad. Sci., 1876.

The localities given by Stimpson for this abundant species range from Sitka to Monterey, and I have two young specimens among miscellanea, collected at Magdalena Bay, Lower California.

No. 25. San Francisco market, dried, male. W. N. Lockington.

Cancer gracilis. Dana U. S. Ex. Exp., I, 153, pl. VII, f. 2. Stimpson, Proc. Cal. Acad. Sci., I, 88; Crust. and Ech. Pac. S. N. A., 20.

The only specimens I have yet seen are those in the museum of the Cal. Acad. Sci.

No. 26. Two females, dried. Locality unknown.

Cancer productus. Randall. J. A. N. S., Phil., VIII, 116. Dana, U. S. Ex. Exp., I, 156, pl. VII, f. 3. Stimp., Proc. Cal. Acad. Sci., I, 88. *Platycarcinus productus*. Gibbes. Proc. Am. Asso., 1050. p. 177. Stimpson, Crust. and Ech. Pac. S. N. A., 21.

This species has been found at Puget Sound, Tomales Bay, S. F. Bay, San Diego, and Magdalena Bay, L. C.

No. 27. Several young specimens from Monterey, dried. Dr. J. G. Cooper.

No. 28. Young, dried. San Diego. Hy. Hemphill.

No. 40. Male, in spirits. S. F. Bay. W. N. Lockington.

Not only are the young of this species very different in appearance from the adult, but they are so variously striped and marked that a superficial examination might cause them to be considered the young of several distinct species. The specimen described by Dana was not fully grown, and, like all the immature specimens I have seen, had the teeth of the produced front low and like lobes, with a short suture on the carapax between each lobe and the next. In the adults, the teeth of the front are more separate and more acute, and the central tooth more produced than the lateral ones; moreover, the nine antero-lateral teeth are distinctly separated from each other, and the body near the antero-lateral margins is thicker than in the young.

The prevailing color of the adult is red, becoming darker and more brownish above, and orange or yellowish below. Among four young ones found under stones at Monterey, two are chocolate, with a somewhat darker tint on the elevated parts of the carapax; a third, bright yellow, with irregular blotches of dark red; and the fourth, yellow, with narrow red stripes, giving it a zebra-like appearance.

An examination of young and adult specimens only would lead to the belief that they were distinct species, but a full series of specimens, of all sizes and ages, reveals their specific identity.

This species is common in the bay of San Francisco, but I have never found either it or its young beneath the stones on the beach, as is the case at Monterey. In April of this year, half an hour's search under the stones at Preston's Point, Tomales Bay, procured me twelve fine adult specimens, all or most of them females. I did not observe any ova attached to them, and I

thought it singular that on a second visit paid to the spot in July, I could not find a single female, though at low tide mark I secured an overgrown male who had lost too many limbs to retreat with sufficient quickness.

Cancer antennarius. Stimpson. Proc. Cal. Acad. Sci., I, 88; Crust. and Ech., Pac. S. N. A., 22.

No. 29. Female, dried. Probably from San Francisco Bay. Wm. Stimpson.(?)

No. 39. Young, between tides. San Diego. Hemphill.

No. 41. Female, with ova. S. F. Bay. W. N. Lockington.

This species appears to frequent deeper water than *C. productus* or *C. magister*, as, though occasionally taken on the lines of the anglers in San Francisco bay, I have never known of its occurrence on the beach between tides. It is found on the ocean shore near Tomales, and occurs as far south as Magdalena Bay, Lower California, where a fine specimen was obtained by Mr. W. J. Fisher.

The sides of the chelipeds are beautifully marbled with dark spots upon a lighter ground in adult recent specimens.

Sub-Family Xanthinæ.

Until very lately not a single representative of this sub-family had been found upon our western shores, probably because the the first collections were made in the neighborhood of San Francisco.

The species named by Stimpson and Dana were collected at various localities from Monterey northward to Sitka, but the coast southward from the former place to Cape St. Lucas, and the shores of the Gulf of California, have been, and still are, comparatively unknown to carcinologists.

All the species of *Xanthinæ* described or mentioned in these notes have been collected in the last mentioned localities by Mr. Hy. Hemphill and Mr. W. J. Fisher.

Those species which I have previously described from single specimens furnished to the Academy by the former collector are most of them more fully known to me by numerous specimens obtained by the latter during five months spent in dredging and collecting along the uninviting shores of Lower California, while those which are new are in every case the results of the same indefatigable collector's labors.

It is somewhat singular that, so far as I am aware, not a single species of this sub-family has yet been found along the shores of Northern California, Oregon, or Washington Territory, and I cannot avoid thinking that further search may disclose some.

The genus *Panopæus* is represented on the shores of Central America by two or three forms which have not hitherto been found so far north as Lower California.

I own myself unable to perceive any sufficient reason for the separation of *Xantho* from *Xanthodes*, but I have relegated two of the narrowest forms to the latter group.

Atergatis cristatissimo. Lockington. Proc. Cal. Acad. Sci., March 20, 1876.
La Paz, San José Island, Amortiguado Bay.

This pretty little species does not appear to occur on the west coast of Lower California.

The color of the carapax in spirits is the same as in the dried specimen, viz., bright red.

No. 30. Two males, dried. From La Paz. D. E. Hungerford.

No. 42. Male and female, in spirits. W. N. Lockington.

Actæa meandricus. nov. sp.

Front four-lobed, antero-lateral margin without conspicuous teeth; postero-lateral margin highly concave.

Entire upper surface of the carapax covered with involved rugæ; those of each areolet distinct; areolets separated by sulci.

Chelipeds equal, their upper outer surface rugose like the carapax, the rugæ giving way to rows of tubercles on the underside of the manus.

Upper edge of the manus and carpus an acute angle; inner surface of both perfectly smooth; meros smooth on both sides, compressed.

Hinder limbs with compressed joints; the meros smooth on both sides, except in the fifth pair; the remaining joints rugose on their upper and posterior aspects. Meros of fifth pair rugose above. Fingers of chelipeds sulcate, short. Sternum cavernous; abdomen with transverse rugæ. Color, in spirits, dull red.

Locality, Mulege Bay, Gulf of California.

Two specimens, a male and female, are all I have seen of this well marked species.

	♂ M. M.	♀ M. M.
Greatest length	20	19
Extreme width of carapax	27	25

This little crab has a peculiarly compact appearance. The rugosities of its limbs are so arranged that when they are folded up close to the carapax not a portion of smooth surface can be seen either above or below, the only smooth portions being lateral and hidden.

Heteractæa. nov. genus.

Form of carapax as in *Actæa*, but with an external hiatus to the orbit, and its lower margin divided into two lobes. Abdomen of male, five-jointed.

I am loth to form a new genus for a species which resembles an *Actæa* so closely in its general aspect and form, which, in my belief, afford far better evidence of the real affinities of any animal than are afforded by variations in the form of the orbit or the length of the basal joint of an antenna; but I have no choice in the matter, as the genus *Actæa* is defined as "without an external hiatus to the orbit," while the genera with the lower margin of the orbit divided into teeth have a seven-jointed abdomen in the male.

Heteractæa pilosus. nov. sp.

Aspect that of an *Actæa*, but the orbit with an external hiatus, and its lower margin divided into two separate lobes. Front two-lobed, upper mar-

gin of orbit a long thick, sinuate tubercle. Teeth of front, upper and under margins of orbit, and a small tooth just external to the outer hiatus of the orbit, red, smooth, shining, and naked. The remainder of the upper surface of the carapax thickly tomentose. Antero-lateral margin with three sharp teeth projecting beyond the tomentosity. Regions of carapax distinct. Chelipeds tomentose, the carpus and manus covered with tubercles arranged in regular series on the outer side of the manus. Right cheliped larger than left; fingers sulcate. Tubercles of manus and carpus red, the red predominating at the distal end of the manus. Longer hairs scattered at intervals among the tomentosity of the carapax; hinder limbs thickly pilose.

Localities, San José Island, Amortiguado Bay; and Port Escondido, both in the Gulf of California.

Several specimens. The largest pair measure as follows:

	♂ M. M.	♀ M. M.
Greatest length....	19	15
Greatest width....	27	20

No. 43. Male and female, in spirits. Fisher and Lockington.

Xantho tenuidactylos. nov. sp.

Front declivous, antero-lateral margin without distinct lobes or teeth, thick; anterior portion or carapax somewhat negose, granulate; carpus and manus thickly covered with large granulations above and externally, the granulations extending on to the upper and outer surface of the fingers; fingers sulcate, those of the right cheliped (which is the larger) rather short; those of the left cheliped exceedingly long and thin. Hinder legs somewhat tomentose.

Color reddish-brown; fingers black.

One specimen only, a female, taken at low tide, on the flats at La Paz, Lower California.

	M. M.
Length of carapax....	15
Width of carapax....	11

Xantho grandimanus. nov. sp.

Carapax transverse, antero-lateral angles not prominent. Front four-lobed, the central emargination running back as a deep sulcus across the frontal regions of the carapax. Upper margin of orbit tumid, backed by a deep sulcus, giving off at a right angle, a sulcus separating the median from the lateral regions of the carapax. Antero-lateral teeth, five; the first two long and low; third low, but somewhat shorter; fourth much shorter and pointed; fifth very small. Areolation indistinct; frontal and antero-lateral regions granulated. Right cheliped very large, smooth, meros hollowed out throughout its posterior upper surface so as to fit closely to the under surface of the carapax; carpus large, heavy and rounded; manus broad, rounded above and without crests or tubercles; movable finger with a very large tubercle at its inner base; fixed finger with three or four tubercles. Left cheliped similar, but much smaller; fingers much smaller proportionately to the manus than

in the larger cheliped; fingers with numerous tubercles on inner surface. Hinder limbs rounded; the two last joints tomentose.

Color reddish-brown; fingers slaty.

Locality, La Paz, L. C.

The dimensions of a large specimen of each sex are as follows:

	♂ M. M.	♀ M. M.
Greatest width of carapax	71	60
Greatest length of carapax	50	41
Length of larger hand	65	50
Length of smaller hand	47	39
Greatest width of larger hand	27	22

No. 31. Male and female and young. Identity of donor unknown.

Xantho multidentatus. Lockington. Proc. Cal. Acad. Sci., Feb. 7, 1876.
No. 38. Male, dried. Mazatlan. Hy. Edwards.

PARAXANTHUS.

Xantho novem-dentatus. Lockington. Proc. Cal. Acad. Sci., Feb. 7, 1876. San Diego; San José Island, Amortiguado Bay.

Four or five specimens only. Color of carapax in spirits, whitish, with a tinge of red, and with red markings. The front is much more produced than usual in this species.

No. 32. Male, dried. San Diego. Hy. Hemphill.

All but one of the specimens from Lower California are smaller than the type specimen which was procured at San Diego, and the carapax is proportionally narrower, yet I believe them to be younger individuals of the same species, founding my belief on the prominent, narrow, entire part, curved outline of the antero-lateral margin, without perceptible angle at its junction with the postero-lateral; and on the character of the left cheliped. the fingers of which are sulcate, and devoid of prominent tubercles on their palmar surface.

Xantho spini-tuberculatus. Lockington. Santa Rosa Island, Monterey, San Diego, Magdalena Bay, San José Island.

This species appears to be of common occurrence along the coast from Monterey southward to Magdalena, but to disappear, or at least become rare, in localities further south.

Dimensions of the largest specimen:

	M. M.
Greatest length of carapax	30
Greatest width of carapax	40

The right hand in this large specimen (a male) is very much larger than the left, but this is not universally the case.

Color, in spirits: carapax greenish, with maroon cloudings; tubercles of first pair and front of carapax bright red; hinder limbs crossed by maroon bands; fingers black.

No. 33. Monterey. Dried. J. G. Cooper.

Xantho Hemphilliana. Lockington, Proc. Cal. Acad. Sci., Feb. 7th, 1876.

The only specimen I have seen of this species is the one in the possession of the Academy of Sciences, San Francisco. Some small crabs from the Gulf of California, which I at first believed to be young specimens of this form, differ in their less transverse form and more perfect areolation, and I now think them distinct, yet this can only be proved by the examination of a complete series of the Monterey form.

No. 35. Large male, dried. Monterey. Hy. Hemphill.

Xanthodes leucomanus. Lockington, Proc. Cal. Acad. Sci., Feb. 7th, 1876.

Carapax rather narrow; areolation very distinct, cardiac region circumscribed; three antero-lateral teeth (the three posterior ones) usually distinct, and directed laterally, the space usually occupied by the first two antero-lateral teeth forming an almost straight line. Basal joint of outer antennæ reaching the front; lower margin of orbit two-lobed; inner hiatus wide; front sinuate, a process meeting the basal joint of the external antennæ. Internal antennæ stout. Chelipeds sub-equal, manus broadly ovate, stouter than the carpus, smooth, shining, with a slightly raised upper edge; dactylus and pollex alike, short and stout, conical, toothed inside; furrowed. Carpus often with a roughened upper surface. Ambulatory feet almost free from setæ, but the dactyli thickly covered with very short tomentosity.

	♂ M. M.	♀ M. M.
Length of carapax	9	8
Width of carapax	11	9.5

Numerous specimens of this species were brought from La Paz, Port Escondido and Mulege Bay, Gulf of California, by W. J. Fisher. They show great variation in color, areolation, and other characters. In some the posterior portion of the carapax is much less distinctly areolated than in others; many individuals have the upper surface of the carpus, and even that of the manus, more or less rugose; some have black fingers with white tips, others have colored fingers, and the general tint of the carapax varies considerably. The original specimens from which my previous short description of this species was written, were lost in removing our collection, and I cannot, therefore, feel certain of the identity of the Gulf form with the one first described.

Xanthodes? angustus. nov. sp.

Carapax narrow, front wide, slightly sinuate; antero-lateral margin shorter than postero-lateral, three-toothed; teeth pointed forwards; the posterior margin of the hindermost teeth in a line with the postero-lateral margin. Upper margin of the orbit two-lobed, excluding the post-orbital, which is lower than the two succeeding antero-lateral teeth. Upper surface of the carapax smooth, shining, without areolation, except in the frontal region, and near the antero-lateral teeth. Chelipeds smooth, shining, without areolation, hairs or tubercles, hands rather broad, equal in size, fingers of right hand tuberculate

on the palmar surface, those of left hand with a cutting outer edge. Hinder pairs of limbs slender, slightly pilose. Color reddish brown (in spirits), chelipeds bright red.

Localities—Magdalena Bay, west coast Lower California; Mulege Bay, Port Escondido, San José Island, Gulf of California.

	M. M.
Width of carapax..........	14
Greatest length.........................	10

These dimensions are from one of the largest specimens.

The *extreme* narrowness of the carapax and shortness of the antero-lateral margin make me doubtful of the propriety of placing this species in the sub-genus *Xanthodes*. Its aspect is much that of a *Pilodius*, but the fingers are not spoon-shaped. There are a few scattered setæ on the two last joints of the ambulatory feet. There is considerable resemblance between this species and *X. latimanus* from San Diego, but the hands of the former are wider and the antero-lateral teeth more robust. The difference in size between the present form and the single male of *X. latimanus* in the Mus. Cal. Acad. Sci. is great, but it is not unlikely that it is either the young or a small variety of that species, but as the gulf species are in most cases distinct from those of the west coast of Lower California, I do not venture to unite them.

Xantho latimanus. Lockington, Proc. Cal. Acad. Sci., Feb. 7, 1876.

No. 34. Male, dried. San Diego. Hy. Hemphill.

Panopœus purpureus. nov. sp.

Carapax convex both longitudinally and transversely, branchial regions tumid, sulcus between gastric and cardiac regions distinct. Surface finely granulated, the granulations with a tendency to form beaded ridges. Intra-medial and extra-medial regions distinct from each other and from the antero-lateral. First two teeth of antero-lateral margin coalesced, forming a prominent bi-lobed tooth; third and fourth teeth curved forwards, the fourth shortest; fifth thick and rounded, directed forwards. Sub-hepatic spine prominent. Inferior margin of orbit three-lobed; interior lobe inconspicuous; middle lobe narrow, thick, projecting; outer lobe long, low, thin, highest on its outer angle. Outer hiatus of orbit deep and narrow. Superior margin of orbit with slight indications of a division into three lobes. Chelipeds smooth, unarmed, the right the larger; propodi and dactyli of hinder limbs beset with short bristly hairs. Color of carapax and upper surface of chelipeds bluish purple, becoming darker in the older specimens. Irregular spots and blotches of a dark brownish purple are conspicuous in the younger specimens, but become indistinct in the older, except upon the chelipeds. Fingers brown, with white tips.

	♂ *Inches.*	♀ *Inches.*
Greatest length of largest specimens	1.30	.95
Greatest width of largest specimens........................	1.75	1.30

Localities—Magdalena Bay, west coast Lower California; La Paz, Gulf of California. Apparently rare, as Mr. Fisher obtained but few specimens.

No. 44. Male and female. Magdalena Bay. W. J. Fisher.

Panopæus transversus? Stimpson, Am. Lyc. Nat. Hist., N. Y., vol. VII, p. 210.

Numerous specimens of a small species of *Panopæus* from Lower California do not agree at all with any of the species described by S. I. Smith, in the Proc. Boston Soc. Nat. Hist., vol. XII, Feb. 3, 1869, and from their transverse shape and the small size of the sub-hepatic spine, may probably be the *P. transversus* of Stimpson. As, however, I have no access to Stimpson's description, I think it well to subjoin a short description, as it may possibly prove to be a distinct species. Front slightly sinuate, antero-lateral teeth four, the two first long and low, the last two more pointed, with the points turned forwards. Right cheliped slightly the larger, both chelipeds smooth, shining, whitish, except on the upper surface, where the tint deepens to a reddish brown, which is the general color of the carapax. Hinder pairs of legs tomentose. Two of the largest specimens measured as follows:

	♂	♀
Length of carapax	0.65	0.56
Width of carapax	0.92	0.80

Numerous specimens were obtained in San Bartolomé and Magdalena bays, and Santa Maria Bay, all on the west coast of Lower California; also, at La Paz, Gulf of California, where it was dredged at (so far as I can make out the label, which was unfortunately torn) a depth of three fathoms. The veritable *P. transversus* was found at Corinto, Nicaragua, by J. A. McNeil (*vide* S. I. Smith, *loc. cit.*).

No. 45. Several specimens, in spirits, from Magdalena Bay. Fisher and Lockington.

Panopæus validus. S. I. Smith, Proc. Boston Soc. Nat. Hist., 1869, 273.

Panama and Acajutla. External opening of orbit broad and deep.

Panopæus Bradleyi. S. I. Smith, *loc. cit.*, 281.

Panama. External opening of orbit a deep notch rather than a groove.

Panopæus planus. S. I. Smith, *loc. cit.*, 283.

Panama. Sub-hepatic tubercle not prominent. Antero-lateral margin with four slight incisions, as in *P. transversus*.

Acanthus spino-hirsutus. Lockington, Proc. Cal. Acad. Sci., Feb. 7, 1876.

The range of this species is much more extensive than that of most of those described in the paper above referred to. The first specimen obtained was brought, with specimens of several other species, from San Diego; but whereas most San Diego forms extend down the western coast of Lower Cali-

fornia, but do not appear—judging from present knowledge—to inhabit the Gulf of California, the present species has been found in abundance at La Paz, Mulege Bay, Port Escondido and San José Island, all within the Gulf. One peculiarity of this form is the bright red tint of the prominent transverse ridge in front of the buccal area. None of the specimens I have seen from Lower California exceed in size that brought from San Diego.

No. 36. Male, dried. San Diego. Hy. Hemphill.

Menippe obtusa. Stimpson, Notes on N. Amer. Crust. (Annals Lyc. Nat. Hist., N. Y., 1858), p. 7.

Panama.

CHLORODINÆ.

No species of this group is mentioned by Stimpson, either in Crust. and Echi. Pac. Shore N. Amer., or "Notes of North American Crustacea." I have here described three species, all of which were brought from Lower California by Mr. W. J. Fisher. Although distinguished as a sub-family on account of the more or less perfect spoon-shaped tips of the dactylus and pollex of the chelipeds, the *Chlorodinæ* are so closely related to the *Xanthinæ* that it would be more natural to intercalate their genera among those of that subfamily; for instance, *Chlorodius* next to *Xantho*, and *Actæodes* next to *Actæa.*

Actæodes mexicanus. Lockington, Proc. Cal. Acad. Sci., March 20, 1876.

Mazatlan, Magdalena Bay, La Paz, where a few were dredged in thirteen fathoms; Port Escondido, Gulf of California; San José Island, Amortiguado Bay, Mulege Bay. The carapax of the largest specimen obtained measures 33 millimetres in width, and 21 in length The color ranges from dark reddish brown, sometimes tinged with green to almost white, and in some cases even the fingers are whitish. Females with ova were collected from July to August. This species is found at low tide, under stones and in coral.

No. 37. Male, dried. Mazatlan. H. Edwards.

No. 46. Male and female, in spirits. Magdalena Bay. W. J. Fisher.

Actæodes xantho. nov. sp.

Carapax broadly transverse, without teeth on antero-lateral margins or front, which slightly curve outwards in front of each areolet. Areolation complete, middle region with nine areolets. The hinder posterior areolet (2*P.* Dana) entire, long and narrow, four smaller areolets between this and the median region, and ten areolets on the antero and postero-lateral regions of each side. Chelipeds short, the meros hidden beneath the carapax, manus and carpus about equal in length, their upper surface covered with tubercles about as large as those of the carapax. All the raised portions of the carapax, and tubercles of areolets covered with granules, the sulci between tomentose. Dactyli of first pair very short, obtuse at end, the tips somewhat hollowed out, but the hollows not circumscribed within. Hinder feet short, compressed, their upper surface with elongated tubercles less distinctly granulated than

those of the carapax and chelipeds, the sulci and terminal joints tomentose. Abdomen tomentose.

	M. M.
Length of carapax	11.5
Width of carapax	18

A single specimen, female, from San José Island, Amortiguado Bay, Gulf of California. In spirits, the areolets are of a bright yellow color. There are five tubercles on the carpus, and as many on the hand. The genera *Actæa* and *Acteodes* are usually placed in separate sub-families, but the artificiality of this separation is evident to any one who compares the species belonging to the two genera. In this species, as in *A. speciosa* and *A. cavipes*, Dana, and *A. mexicanus* (*mihi*), the tips of the fingers are but imperfectly excavate, and the forms belong as truly to *Actæa* as to *Actæodes*. The two genera form, in fact, a continuous series of closely allied species.

Chlorodius Fisheri. nov. sp.

Similar in proportions to *C. sanguineus*, Edwds, but the carapax is widest between the posterior teeth of the antero-lateral margin. Front 4-lobed; a deep emargination between the long central lobes. Teeth of antero-lateral margin five in number, acute, sub-equal, and directed forwards Areolation less distinct than in *C. sanguineus*; areolets well-defined anteriorly, but not posteriorly. Pre-medial areolets joined to the extra-medial; intra-medial separated from the posterior or cardiac by a distinct sulcus; areolets of antero-lateral region six in number; postero-lateral and posterior regions without distinct areolation. Chelipeds equal, smooth, except a tooth on inner angle of carpus; all the fingers spoon-shaped, but the cavity not circumscribed within. The fingers are sulcated. Posterior legs slightly setose, claws sharp.

Color. Carapax, greenish red; chelipeds, marbled with purplish red, white beneath; fingers, black. Length of carapax of largest specimen (male), 0.78 in.; greatest width, 1.06 in.

Numerous specimens from the West coast of Lower California, collected by W. J. Fisher, also from La Paz, San José Island, Mulege Bay and Port Escondido, all in the gulf of California. It is found on the flats at low tide.

No. 47. In spirits, Magdalena Bay. W. J. Fisher.

Family ERIPHIDÆ.

27. *Ozius verreauxii.* De Saussere. Revue et Magasin de Zoölogie, V, 359, pl. XII, f. 1.

Mazatlan.

28. *Xanthodius sternberghii.* Stimpson. Notes on North American Crust. 6.

Panama.

29. *Pilumnus limosus.* S. I. Smith. Proc. Bost. Soc. Nat. Hist, XII, 286, 1869.

Panama. Peru.

30. *Eriphia squamata.* Stimpson. Notes on North American Crustacea, p. 10. (Annals Lyceum Nat. Hist., N. Y.)

Panama. Corinto, Nicaragua.

31. *Trapezia formosa.* S. I. Smith. Proc. Bost. Soc. Nat. Hist., Feb. 3 1869.

Pearl Islands, Bay of Panama, among *Pocillopora capitata*, Verrill.

32. *Trapezia cymodoce?* Guerin. Dana. U. S. Ex. Exp., p. 257, pl. XV, Fig. 5. S. I. Smith, *loc. cit.*

Locality the same as the preceding species.

33. *Quadrella nitida.* S. I. Smith. *loc. cit.*

Locality, Pacheca, one of the Pearl Islands, 6 to 8 fathoms, among pearl oysters.

When Stimpson, in 1857, published his "Crustacea and Echinodermata of the Pacific Shores of North America," not a single species of the large family *Portunidæ* had been discovered. The same naturalist in his "Notes on North American Crustacea," published in 1859, mentions one species, *Lupa bellicosa*, Sloat, MS., but gives no description, remarking that it "agrees with *L. hastata* in almost every character, except that the last two joints of the abdomen in the male are broader and more flattened."

In February of this year I described a second species, a specimen of which had been procured the preceding year at Mazatlan by Mr. Henry Edwards; and I shall in this paper describe a third, of which many individuals have been collected by Mr. W. J. Fisher at various points on the Western and Eastern shores of Lower California. At Magdalena Bay Mr. Fisher procured several very specimens of a *Lupa*, which I take to be the *L. bellicosa* of Sloat and Stimpson, but as Sloat's MS. is not on hand, and Stimpson gives no figure, my sole reason for this belief is that the other two known species from Lower California, belong to the genus *Amphitrite*, as defined by Dana.

That there may be no confusion I append a description of this *Lupa*.

Lupa bellicosa? Sloat, MS. Stimpson. Notes on N. Amer. Crust., p. 11.

Carapax regularly arched in its longitudinal and transverse directions; exceedingly wide, the post and antero-lateral outlines forming a long ellipse; no areolation except a sulcus between the median and posterior regions. Central tooth of front placed low down, between the internal antennæ, and separated by a short, somewhat pilose, space from the front proper, which has two lateral spines separated by a sinuous central portion. Upper margin of the orbit consisting of two long teeth, an ante and post-orbital; the former highest above the outer antennæ, and separated by a deep notch from the latter, which is two-lobed, the anterior lobe low, and the posterior long and pointed. Antero-lateral teeth nine, including the posterior lobe of the post-orbital, which exceeds in height any of the others except the ninth. 2d, 3d,

4th, 5th, 6th, 7th and 8th antero-lateral teeth equal, all broadly triangular. Ninth tooth much the largest, its upper ridged edge continuing across the carapax for some distance. Lower margin of the orbit pilose, rising into a conspicuous tooth immediately below the outer antennæ. Underside of carapax and sternum without hairs, except below the hinder part of the antero-lateral regions. Meros of first pair trigonal, with four sharp spines on its upper anterior edge and two blunt teeth at the distal extremity of its posterior edge. Carpus with two or three ridges exteriorly, and some short, blunt spines anteriorly. Manus with a triangular tooth next the carpus on its upper anterior edge, and also a blunt tooth at the distal extremity of its upper posterior margin. Dactyli only slightly sulcate; the teeth of the inner margins in groups of three; the central one largest. Second, third, and fourth pairs of limbs stout; the two last joints compressed and sulcate, pilose posteriorly. Fifth pair stout, without sulcations on the last two compressed joints.

Several fine specimens of this species were brought from Magdalena Bay, by Mr. W. J. Fisher.

The dimensions of a large individual, of each sex, are as follows:

	♂ M. M.	♀ M. M.
Length of carapax	6.	5.3
Greatest width of carapax	11.5	10.2
Length of right manus	7.	5.

The color is almost brown above, cream-colored below, the tubercles and ridges of the manus tinged with red.

No. 22. Male, in spirits; fine specimen. Fisher and Lockington.

Lupa dicantha. M. Edwards. Hist. Nat. des. Crust., tom. 1, p. 451. Dana. U. S. Ex. Exp., 1, 272, pl. XVI, fig. 7, T. Hale Streets. Proc. Acad. Nat. Sci., Phil., 1871, p. 239.

Amphitrite Edwardsii. Lockington. Proc. Cal. Acad., March 20, 1876.

On looking over a number of Amphitrites from Lower California, I found one only, a large female, that can be referred to this species.

It presents all the characters of the type in the Academy's museum, but in a more marked degree from its larger size. The nine spines of the antero-lateral margin are alternately large and small, the ninth no larger than the first, third, fifth, and seventh; and the points of all are black. The meros of the first pair of legs has five black-tipped spines, that nearest the carpus smaller than the central three and equal to the proximal one. The inter-orbital teeth are eight in number, and the ridges across the carapax well defined. The spines of carpus and manus agree exactly with those of the smaller specimen, previously described, and all are tipped with black.

The general color of the carapax and limbs, in spirits, is red, with lighter marblings. The tips of the fingers are black.

	M. M.
Extreme width of carapax	51
Extreme length	32
Length of movable finger	13

The upper part of the carapax is thickly tomentose, except upon the ridges. This species is well marked, and readily distinguished from the following.

No. 23. Female, dried. Mazatlan. Hy. Edwards.

Amphitrite paucispinis. Lockington.

Inter-antennal front four-lobed; pre-orbital spines slightly two-lobed. Antero-lateral spines were nearly equal in size, except the ninth, which is twice the length of the others. The outline of front portion of carapax between the last antero-lateral spines, on each side, is a regular ellipse. Posterior to the last antero-lateral spine the carapax contracts suddenly in width, so that the postero-lateral margins are L-shaped. Meros of first pair with four spines on its anterior margin, the proximal smallest. Carpus with one spine on the interior upper margin, and two on the exterior. Manus with one spine only, on its upper margin, forming the extremity of a carina. Four slightly beaded ridges on the outer side of the manus. Fingers sulcate, tubercular on the palmar margin, the movable finger with a large tubercle at the base. Second, third, and fourth pairs of limbs slender; penultimate joint of fifth pair sulcate and surrounded, as is also the last joint, with a regular fringe of hairs. Areolation of carapax very distinct; the summits of each region granulated.

The dimensions of two of the largest specimens, both female, are as follows:

	M. M.	M. M.
Extreme width from tip to tip of spines	40	54
Greatest length....................................	23	30

Localities—Angeles Bay, Mulege Bay, both in the Gulf of California; Magdalena Bay, West Coast Lower California.

The specimens were collected at low tide in August and September, and many of the females have the ova attached.

No. 24. Two males, dried. Magdalena Bay, West Coast Lower California. Fisher and Lockington.

Arœneus bidens. S. I. Smith. Report Peabody Acad. Sci , 1869, p. 90.

Callinectes sp? "Agrees with Ordway's *C. arcuatus.* Bost. Jour. Nat. Hist. VII, p. 578, except that there is only one distinct spine on the carpus of the chelipeds." S. I. Smith. *loc. cit.*

In my last paper upon this subject, two species of Maioid crabs mentioned in a "Catalogue of Crustacea from the Isthmus of Panama," by T. Hale Streets, was included, viz.: *Homalacantha hirsuta* (T. Hale Streets), and *Mithraculus coronatus* (Stimpson). Mr. Streets does not state on which side of the Isthmus the various species enumerated in his catalogue were collected; therefore, although I am aware that in some cases the same species occurs on both sides, I shall not in future include in this catalogue any but undoubtedly Pacific species.

Mr. Streets describes the following new species, giving Isthmus of Panama as their locality:

Mithraculus coronatus.
Aniculus longitarsis.
Cenobita intermedia.
Gebia longipollex.
Alphæus bispinosus.

The following species included in his list are Atlantic forms, some of which may possibly occur in the Pacific, also:

Mithraculus coronatus, St.......................Gulf of Mexico, Brazil.
Carpilius corallinus, M. Edwards..............................Antilles.
Actæa labyrinthica, St.? ....
Menippe mercenaria, St.......................................Atlantic.
Lupa rubra, M. Edwards...Brazil.
Ocypoda rhombea, M. Edwards.........................Antilles, Brazil.
Uca lævis, M. Edwards...................................Antilles, Brazil.
Hippa emerita, M. Edwards...............................Antilles, Brazil.
Cenobita diogenes, M. Edwards..................................Antilles.
Panulirus guttatus, Latn. M. Edwards.........................Antilles.
" *americanus*, Lamk. M. Edwards.............................Antilles.

The following probably reach as far north as Panama, and are therefore referred to in their order:

1. *Panopæus chilensis.*
4. *Ocypoda Gaudichaudii.*
2. *Lupa dicantha.*
3. *Eriphia gonagra.*

W. N. Lockington read the following:

Notes on Californian Fishes.

BY W. N. LOCKINGTON.

Raia batis. Linn.

Uraptera binoculata. Girard.

Dr. A. Gunther, in the Cat. Fishes Brit. Mus., Vol. VIII, p. 465, states his belief that the latter of these fishes may be regarded as a climatic variety of *R. batis.* He goes on to say that "young examples have a round obscure spot on each pectoral fin."

Had Dr. Gunther seen the fish alive, or in a fresh condition, I think that his opinion would have been different, but, as the Catalogue shows his only specimens were young, one from San Francisco, presented by Dr. W. O. Ayres, the other a skin only, presented by J. Keast Lord, from Vancouver Island.

I have myself seen specimens of large size in which the spot is as distinct as in the young, and though I cannot say I have measured them, I feel assured that one I saw in the aquarium at Woodward's Gardens about a year ago was two feet across the fins; and that the one now there is about eighteen inches.

Moreover, the eye-like spot in the centre of the pectoral is anything but obscure in the recent fish, it is most conspicuous.

But this is not all. We have in our possession a fish (caught in San Francisco Bay,) which agrees in every respect with the description of *R. batis* in the Brit. Mus. Cat.

I subjoin the dimensions—

	INCHES.
Width across pectorals	18.38
Tip of snout to centre of posterior jaw	4.12
" " anterior edge of anus	12.75
" " " " orbit	4.12
Tail to back of ventrals	8.75
Inter-orbital space (width of)	1.37
Width across ventrals	7.50

Body and fins of a uniform slaty brown color. The difference in aspect between this fish and the *Uraptera* or *Raia binoculata* is very great.

Centropomus. Sp.?

Body oblong, compressed; head contained four and a half times in the total length; outline of top of head nearly straight, slightly concave, ridges of upper surface prominent; depth increasing to origin of first dorsal, thence nearly equal to root of second dorsal, thence decreasing gently to peduncle of tail. First dorsal with eight spines—the first minute; the second about one-sixth the length of the third; third, longest, very stout; fourth, fifth, sixth and seventh rapidly decreasing; eighth, prostrate. Pectorals small, extending to little more than the half length of the ventrals, which exceed them in size. First spine of anal very small; second, long and stout; third, slender, but slightly the longest. The orbit is slightly elliptical. Lower jaw protruding beyond the upper; maxillary, when the mouth is closed, extending to a perpendicular from the centre of the pupil. Teeth nominal. Pre-operculum strongly serrated. Color, when fresh, back to lateral line dark green, becoming lighter below, and whitish on the belly. Snout, green, yellow on the sides. Iris, golden. Pectorals, lead-color, with green centre; ventrals, the same. Caudal, lead-color in centre, with green margins. Dorsal, green, with bluish stripe, and tipped with golden. Fin-formula, D. $8 \mid \frac{1}{10}$; A. $\frac{3}{6}$. Branchiostegals, 7. The following are the principal dimensions of the specimen presented:

	Ft.	*In.*
Total length, from tip of lower jaw to end of tail	1	5.5
Length of head, from tip of upper jaw		3.88
Tip of snout to origin of first dorsal		5.5

Origin of first dorsal to origin of second dorsal	3.35
Length of third dorsal spine	2.25
Length of base of first dorsal	2.75
Length of base of first anal	1.5
Eye to tip of snout	1.3
Circumference at origin of spinous dorsal	7.5
Width of inter-orbital space	0.63

The single specimen was taken by Mr. W. J. Fisher, off Asuncion Island Lower California, at a depth of eight fathoms.

The proportions and coloration of this fish agree very nearly with those of *Centropomus undecimalis*, Cuv. and Val; and I strongly suspect its identity with that species, which is, however, not known to me from specimens or figures.

C. undecimalis is a native of the Atlantic shores of tropical America; but Dr. Gunther queries its occurrence at Lima. If it should prove, on further acquaintance, to be a distinct species, I propose to name it *Centropomus viridis*.

Dr. Kellogg submitted the following:

On some New Species of Californian Plants.

BY DR. A. KELLOGG.

Dr. G. Eisen's specimens of *Carpenteria Californica* in full flower enable us to record some further items of interest. In these the flowers are pure white, fragrant, 2–2½ in expansion; bracteoles ovate, acute, instead of "subulate," only ¼ inch below the flower, and as the central peduncle has none, under high culture, it is fair to presume these would prove only reduced normal leafy bracts; the petioles are connate at base, often shortly sheathing. The flattened cymosely-pannicled masses of flowers show it to be a more compact bloomer than our *Philadelphus* species, which it so much resembles; the intermixture of buds with the open flowers also indicate a lengthened period of bloom. This must prove a most valuable ornamental acquisition.

In Dr. Eisen's collection we also find a new species of Blazing Star, or *Mentzelia crocea*. K.

Annual (?) stem branching two feet or more high, bark white, ashy puberulent and scabrous, hirsute with rather long white simple hairs above, leaves oblong, pinnatifid, lobed, upper ovate-lanceolate, acuminate, sessile, sinuate-pinnatifid or toothed; flowers axillary and terminal; subtending bracts ovate-acuminate, coarsely toothed or sub-lobed. (1–2 on each side.)

Capsule, slender, clavate or gradually enlarging above to the truncate top; sessile, hirsute, an inch or more long; immature seeds, flat. Calyx segments ovate-lance-acuminate—half the length of the stamens, or about ⅓–¼ the petals; hairs on the back from conspicuous elevated gland-like bases; petals five, oval or oval-oblong, abruptly short-acuminate, golden satiny yellow, on a very short saffron-colored claw; flowers large (2–2½ inches across); stamens

very numerous, free, golden filaments, with the lower third deep saffron-hued, oblong anthers, spirally twisted, like short sections of fine cord; style exserted, simple, or altogether undivided. A very beautiful saffron-eyed species; hence the specific name.

Vice-President Edwards, seeing it stated in the Cal. Bot. that the *Aralea Californica* "had not been collected in mature fruit," brought a specimen for record. The berries are deep purple, pulpy, symmetrically smooth, and round as the largest shot, or very slightly oblate-spheroid, shortest diameter the axis, consisting of five oblong, semi-oval, compressed seeds, somewhat bluntly margined on the outer more curved edge. The ripe fruit is apt to fall away, or, if retained, is so crushed that the color, form and character to an extent is lost, which may account for the remark.

In Dr. Eisen's collection is a small form of *Madia glomerata*, var. *eglandulosa*, K., worthy of note. Stem simple, 5–6 inches high, cymosely clustered at the top, hirsute throughout, without glands; lower leaves opposite, rarely alternate except above first and second pairs, subspatulate to linear, acute, obscurely three-nerved, base cilliate, subsessile to sessile; heads turbinate, rays 7–9, yellow, three-lobed or deeply three-toothed; disk florets, 7–10, tubes naked, pappus of five or more long plumose awns, receptacle convex, fimbrillate, pitted.

Among Dr. G. Eisen's prairie collection, Fresno County, is an exceedingly minute plant, which ought to belong to *Heterocodon*, although, as at present characterized, it is quite at variance.

Heterocodon minimum. K.

Stem filiform, ½–1 inch high, simple or branching from the base, more or less hirsute throughout; leaves alternate, general outline broadly fan-shaped, three-lobed (save 1–2 of the lowermost round or oval, entire or crenate, often opposite), principal leaves also subdivided into 2–3 lobules, or deeply cleft-toothed, the middle larger lobe broadly cuneate, three-cleft-lobed, the lateral lobes into mostly two lobules; petioles about as long as the lamina, upper-bractoid leaves becoming cuneate fan-form 5-3-two-cleft-lobules, including the confluent stipules, and subsessile to sessile; stipules large adnate to the petiole, stem-sheathing, entire, or 1–3 coarse teeth on each side; flowers axillary, or becoming so, 2–4 from the axils of each leaf, pedicels unequal, about ½–1 line long, calyx superior (?), herbaceous lobes 3–4, subulate, entire, about as long as the spheroidal tube or capsule; flowers none (hitherto seen); the globose capsule densely hirsute, somewhat constricted at the origin of the calyx segments, which are tipped like the lobules or teeth of leaves and stipules by a long spinulose hair, one-seeded (more?), seed glabrous, pyriform. Rarely a leaf is seen somewhat pinnatifid; those tiny plants are found flowering and fruiting only three-lines high.

Another almost microscopic plant of the prairies of Fresno, collected by Dr. Eisen, is a new

Stylocline acaule. K.

Stemless heads sessile on the root crown in the earth, rarely upon it; size of whole plant, ¼–½ inch (range of fifty specimens); leaves spatulate, oblong lamina, acute, tipped with a black gland or callous, white-woolly, narrow, petiole expanding towards the base; outer scales and seeds as in the generic description; the five inner more rigid ligneous involucrate series of scales surrounding the sterile flower, narrower, acute, woolly on the inner face, glabrous outside; the single floret purple tipped; neither pappus nor setiform hairs.

Also among Dr. Eisen's collection we find the matured fruit of a beautiful evergreen shrub, 3–5 feet high, the fruit of which has been hitherto unknown, on which we offer a passing remark. In this specimen of *Leucothæ Davisæ*, Torr., the somewhat erect raceme from the final axils of the leaves is solitary (the embryo buds at the base, however, show that under favorable auspices it would be clustered); the pendulous flowers become somewhat erect at maturity; the lower bracts of the base are short, rounded-cordate, cinnamon brown; the bracteoles above more oblong, acute; the pedicels have also one or two bractlets a little below the calyx, persistent; at length, as the fruit matures, become more or less deciduous; these are ovate acute; capsule depressed, globose; valves thin, dry, chartaceous, almost translucent, subangled and celled, opening loculicidally, each cell 1–2 seeds maturing out of about 12 ovules; seed oblong-ovoid, slightly a little curved, rugose-pitted.

Among Dr. Eisen's plants we find a form of what we take for *Gilia achilleafolia*, var., wherein the stem is very scabrous, and scabrous glandular heads, base, and the leaves, at their axils, woolly; the leaves 2–3 inches long, loosely pectinate-pinnatifid, linear lobes in 3–6 pairs, ½–1½ inches long (rarely a lobe subdivided); sparsely hirsute, petioles ½–1 inch long, woolly ciliate; flowers smaller, stamens exserted; style shorter, and stigmas simple, etc.

Sierra Nevada, at 4,000 feet.

Among a package labeled "Vicinity of San Francisco," is a novel species of *Prosartes*. Stem, 1–1½ feet high, pubescent, two branched; leaves, 2–2½ inches long, 1–2 inches broad, subabruptly, acuminate, somewhat obliquely cordate, closely clasping, pubescent, margin finely ciliate (scarcely scabrulose?). Perianth unequal, green or foliaceous, obscurely nerved, base acute; sepals, 2–3 lines long (rarely 4 lines), 1–2 lines broad—the two outer being the largest—outermost, and largest of all, ovate, or obovate, subacute; opposite sepal oblong, subobtuse, the very short base slightly narrowed—the three inner narrower; sepals lanceolate (all more or less obscurely nerved). Stamens scarcely a little unequal exsert. Anthers linear-oblong, slightly enlarged at base, saggetate, glabrous, 1½–2 lines long, filaments somewhat unequal, short, style glabrous, simple. Fruit not known.

Among Dr. Eisen's Fresno plants is *Bæria platycarpha*, Gray. Flowering in March. This shows some latitude of variation from the received description worthy of a passing note. In plants of equal stature the parts are reduced in number; *e. g.*, the involucral scales are only five, instead of 6–7; awns of pappus, 3–4, instead of 7–8; leaves remotely laciniate toothed, three-nerved, reticulate veined, etc.

Among Dr. G. Eisen's Fresno collection is a marsh herb of the *Gratiola*-like group, although quite at variance with the 2-fertile stamened genera and species, with transverse, confluent, or united roundish, or even saggetate anthers; besides, in this plant they are not approximated, nor is the style simple, lips of stigma flattened, etc. The peculiar features, therefore, necessitate generic recognition, whatever may be best deemed their ultimate destination.

Ranapalus. K.

Calyx 5-parted, unequal in size, about equal in length, outer three broadest; crolla bell-funnel form, tube short, throat ventricose with a sub-rotate border, glabrous within, about equally 5-lobed, segments flat, somewhat lipped—⅖ upper larger (?)—cleft or deeply emarginate; lower three more spreading; stamens four, all fertile, subdidynamous, erect, distant, subexserted, nearly equal; anthers of two distinct elliptical cells, vertically parallel, fixed by the middle to a flattened subulate simple filament; style straight or scarcely a little curved, nearly as long as the stamens, about equally 2-lobed, stigmas capitate, crenated or toothed (rarely again subdivided); capsule inclosed chiefly by the two largest segments of the calyx, 4-valved, completely 2-celled by the free placenta; seeds covering the whole surface. Generic name from *rana* (frog), *palus* (swamp), its habitat, to indicate its North American representation of the South American genus *Ranaria*, with which it is almost identical.

Ranapalus Eisenii. K.

Roots, fibrous; stem, a span high, dichotomously much branched from the base, lateral branches often prostrate, sarmentaceous, not articulated, compressed, 3-nerved, more or less pubescent, or subglabrous below, almost hirsute above; leaves opposite, sessile, obovate, obtuse to obovate-oblong, often a little oblique, slightly narrowing at the broad base, glabrous, sparsely dotted, fleshy, entire, about 5–10-nerved; peduncles axillary, solitary (or 1–2), compressed, pubescent, about as long as the leaves, ½–¾-inch long, 1-flowered. The color of the flower creamy white, chrome yellow shaded throat and tube, indigo blue anthers; capsule ovate-oblong, acute, many seeded, inserted over the broad surface of the placental partition, chiefly along the longitudinal double dark central band of each cell; seeds linear-oblong, slightly narrowing to the base, rough, cinnamon brown, scarcely appendiculate, and very obscurely margined. Flowers, 4–5-lines across, and about the same in length.

The resignation of Theo. A. Blake as Corresponding Secretary, was read and accepted, and the appointment of his successor referred to the Council.

Mr. Harford exhibited curious samples of wool, growing first black, then white, then black again—not colored artificially. Presented by B. P. Flint & Co.

REGULAR MEETING, SEPTEMBER 18th, 1876.

Dr. A. B. Stout in the Chair.

Sixteen members present.

Among donations to library were five volumes, presented by Alfred A. Pinaut. Dr. Stout read the translation of the titles: "Library of American Linguistics and Ethnography" (3 volumes); "Voyages to the Northwest Coast of America," Part I—The Cavern of Aknañh, Island of Ounga, Alaska.

A special vote of thanks was passed to Mr. Pinaut for his valuable contribution.

Botanical Papers.

BY DR. A. KELLOGG.

In Dr. G. Eisen's collection is a small and slender Asteroid, which in general appearance suggests some forms of *Polygonun tenue* or *P. avicularis*. Stem purple at the base and insertion of the leaves, otherwise grassy green.

Aster tenuis. K.

Stem perennial, ½–1 foot high, slightly flexuous, erect, glabrous, compound racemose-panniculate with short, rather closely erect branches, few flowered; flowers very small, 3–4 lines broad; leaves 1–3 inches long, 1–4 lines broad, lower, short, spatulate, mostly entire; higher cauline lanceolate-linear, narrowing into 3-nerved winged petioles, one inch long or less, base half-clasping, minute corneously denticulate remotely above the middle, laminæ firm, glabrous, translucently reticulate veined, margins scabrous; size diminishing above into sessile ovate-oblong lance-subulate, near the base of the obconic involucre; scales of the involucre loosely imbricated in 4–5 series, the outer shorter, rigid, green, scarious, entire margins, linear, lance-pointed, violet-tipped apex corneously subulate, often recurve-hooked, inner and inmost, linear, longer, scarious, sharply acute, rays pistillate, rose-red, 20–30 or more in a single row, very minute, slightly exsert beyond the pappus, fertile; disk florets few, about five, filiform tube gradually enlarging to the 5-toothed pinkish border; branches of the style short, subulate, scarcely a little clavate towards the acute apex; akens linear-oblong, slightly compressed, apparently nerveless, very minutely appressed, pubescent—of the rays, slightly narrowed above and below—of the disk, diminishing from the somewhat truncate top to base; receptacle minute, rather deeply alveolate.

Among Dr. Eisen's collection is a *Rannunculus* quite distinct from *R. Californicus*, Butte, although allied; also from *R. Nelsoni*, var. *tenells*, Gray. The leaves in this, not being pennately ternate, nor any tendency to a trifoliate character, but are continuously trifid, and of like features consistently throughout, to the least bracteoles, where it vanishes.

Rannunculus. Eisenii.

Stem slender, one foot high, base somewhat ascending, thence erect, panniculately branching, glabrous, or subglabrous below, sparsely pubescent above; radicle leaves on very long slender petioles, 6–8 inches, 3-parted, segments cuneate, nerved, trifid, the lobes often again cut-toothed, glabrous, or very obscurely a little pubescent, in general outline broadly fan-shaped with a subcuneate base; cauline leaves of like form, on petioles 1½–¼ inch long, or sessile at the top and at length, the bractoid ones either lobed or filiform linear; the slender peduncles 1–3 inches long, somewhat pubescent; sepals yellow, ovate-oblong, acute, slightly pubescent, strongly reflexed, shorter than the petals, oblong-subobovate; flowers about 6-lines broad; akenes smooth, scarcely a line long, a little flattened, edges from sharp becoming somewhat obtusely rounded, beak strong, short and recurved; heads compact globular, 2-lines in diameter.

Scutellaria Bolnderi, Gray., in Dr. A. G. Eisen's collection, have ovate leaves, or perhaps ovate-oblong, and all are essentially on petioles, 3–1-line long, in 1–2 of the topmost pairs (out of twenty-five pairs) only subsessile—all distinctly serrate, with coarse truncate teeth below the upper third.

Clematis ligusticifolia has from 4–6 or 8 sepals, top of the climber pubescent, leaves 2–6 inches long (petioles) of 3-pairs and odd leaflet, the lower pair again ternate, pubescent beneath and on the margins; genitals scarcely half as long as the sepals (exceptional?); outer filaments widely flattened or petaloid.

In *specularia biflora*, Gray, Dr. Eisen's specimens exhibit some features worthy of note. Stems ascending, branching from the base, angled, short reflexed; strigose or strignlose-hispid along the angles, chiefly below, only scabrulose backwards above; lower leaves obovate obtuse, more or less decurrent into petioles ¼-inch long, or about half the length of the lamina to very short, and so sessile to clasping (3–6 inches above the base); flowers 1–3 in the axils; otherwise as described.

Dr. Burleigh presented to the Academy's Herbarium a small *Gentiana*, of the stipitate group, closely allied to *G. glauca*, from St. Paul's Island, Alaska, but as in the description of that species no notice is taken of the denticulate lobes of the flowers, etc., we furnish the following description:

Gentiana glauca, var. *Paulense*.

Stem ½–2 inches high, erect or ascending, often branched from the base; perennial root of creeping and thickened fibres; lower leaves obovate-cuneate, decurrent into short-winged petioles, above ovate sessile, about ½-inch long, ¼-inch wide, fleshy, smooth on the margin, 3-nerved and reticulated base, con-

nate and short-sheathing, approximated or crowded, the final leaves colored, bracted and involucrate to the terminal fascicle of 3–6 flowers, besides a few axillary and solitary below. The calyx is tubular-campanulate 4-lines long, upper portion somewhat inflated, membranaceous, colored (blue, like the flowers); teeth unequal, about ¼–⅓, the tube somewhat triangular, base thence acute, smaller segments linear-lance subulate; corolla tubular, slightly inflated above the calyx, but again a little constricted at the throat, lobes five, very short, ¼–⅓ the flower, ovate, subacute, margins minutely denticulate, beardless within, infolded and entire at the simses, ½–¾-inch long, 2-lines broad; filaments from half a line becoming 4–6-lines long, anthers saggitate oblong acute; ovary elliptical, as long as the stipe; seeds minute, scarcely oblong, rough, very obscurely wing-girded.

Description of three New Species of Sessile-Eyed Crustacea, with remarks on Ligia occidentalis.

BY W. G. W. HARFORD.

Ligia occidentalis. Dana.

In some alcoholic miscellanea sent from Magdalena Bay, L. C., by Mr. W. J. Fisher, we found thirty to forty individuals of the above species, which agree sufficiently well with Prof. Dana's description of *L. occidentalis* to be readily referred to it, although some points of difference between our specimens and the Professor's definition of that species, may be of interest.

According to Dana's description, the number of joints in the flagellum of the outer antenna is from 16 to 18. I have counted the joints in the flagella of six individuals, with the following result: 28, 26, 28, 24, 24, 28. The specimens from Lower California do not clearly show the coloration often so conspicuous in individuals of the same species found on the shores of our bay, yet it is evident upon a close examination. The irregular black dots on the limbs of this species are very constant, and in form suggest Arabic characters.

Dexamine scitulus, n. sp.

Upper antenna longest, the short third joint of its peduncle extending to the middle of the third joint of the lower. Second joint of the lower antenna about one-third longer than the corresponding joint of the upper. Flagellum of lower antenna ciliate on lower side. Eyes small and indistinct. First gnathopoda weak, hand of second obovate, carpus slightly produced inferiorly with a bundle of setæ on the same edge. Telson single.

Length, 1 inch.

Dredged in six fathoms Magdalena Bay, Lower California, by Mr. W. J. Fisher. My description is made from a single specimen. It is the most beautiful amphipod I have yet met with, and when first taken from the water must have been a most attractive object. Color light purple, with deeper dottings of the same color on the epimera. I regret that more of this inter-

esting species were not received, that I could have furnished the Academy a good series.

Idotæa marmorata, n. sp.

Body rather slender; outer antenna about half the length of the body; fifth joint nearly equal to the united length of the third and fourth. The posterior margin of the cephalon and the anterior margin of second segment, dorsally contiguous. Four first segments of the pereion equal, and about one-third longer than either of the following. The emarginated caudal shield is longer than the four preceding segments.

Length, $\frac{11}{20}$.

I place the above species in the genus *Idotæa*, in which Milne Edwards includes *Stenosomæ* and *Sidurіæ*, of Leach, and the *Leptosomæ*, *Hebe*, *Oliskæ*, *Zenobiæ*, and *Armidæ*, of Risso. Our specimen possesses the long antenna and somewhat slender form of *Stenosomæ*. The suture between the first and second segments of the pleon is just discernible at the lateral outline only, no trace of it being visible when viewing the caudal plate from above. Our specimen was collected and sent to us by Mr. W. J. Fisher, from the west coast of Lower California. It is a very pretty species, its marbled coloration suggesting the specific name we have given it.

Idotæa muricata, n. sp.

Outline elliptical. First four segments of the pereion equal, the last three decreasing gradually; each segment traversed by a transverse dorsal ridge, bearing three muricoid spines, between which and the lateral margin of each segment are from four to six small tubercles. Abdomen rapidly narrowed to an obtuse, horn-like point. Eyes prominent. Antenna not seen.

Length, $\frac{7}{16}$ in.

The species above described was obtained by Mr. W. J. Fisher, from Icy Cape, about three years ago. Its very rough dorsal surface clearly distinguishes it from all other members of the genus with which we are acquainted; in fact, it differs so greatly from all species of *Idotæa* we have hitherto seen, that we were inclined to form a new genus for its reception; but as no less than seven genera are included in *Idotæa* by M. Edwards (and subsequently by Bate and Westwood), of some of which we have not seen the descriptions, we have placed it as above. Our single specimen is without antenna, they having been broken off in transit.

The eyes are prominent, and in advance and above each is an irregular shaped and apparently hollow spine, posterior to the frontal outline of the head, at a distance equal to their heighth. The cephalon, like the body, possesses the same rough tuberculose character.

The Secretary read the introduction of a paper "On the Determination of the Constant g," communicated through the Corresponding Secretary by E. Dyer.

Thomas Guerin spoke of the cost and weight of conduit pipe, and suggested, that, as there was so much difference of opinion among inquirers with reference to the subject, a discussion would be serviceable at a future meeting.

The appointment, by the Council, of Dr. A. B. Stout as Corresponding Secretary for the unexpired term of Theodore A. Blake (resigned) was announced.

Regular Meeting, October 2d, 1876.

Vice-President Hyde in the Chair.

The Chairman stated that a communication had been received from the Society of California Pioneers, inviting the Academy to attend the funeral of James Lick.

The following gentlemen were appointed pall-bearers on behalf of the Academy: Henry Edwards, Henry C. Hyde, Charles G. Yale, C. D. Gibbes, C. Troyer and S P. Christy.

Mr. R. E. C. Stearns addressed the Academy as follows:

Members of the Academy: It is customary, in societies like this, upon the death of a member, to formally announce the fact and to record the same in the proceedings.

In pursuance of this formality, it has been assigned to me to tell you what you have already heard, and what half the world has already learned through the telegraph and the printing press, that James Lick, our friend and benefactor, has passed away. He died peacefully at one o'clock yesterday (Sunday) morning, October 1st, at the advanced age of eighty years.

It is eminently proper that we should speak in praiseful language of the dead, for, aside from a general feeling of gratitude for his munificent benefactions, which would justify our eulogy, he was one of the earliest members of the Academy, and always

expressed the most friendly interest in its affairs, a warm appreciation of its objects, as well as a generous sympathy for those who were unselfishly working to build up a scientific organization, and to advance the cause of science on the western shores of our country.

Though not educated in those higher schools where the mind is trained to scientific study and thought, his native breadth of mind was nevertheless quick to perceive the lofty aims and grand successes of Science, and the many blessings she has conferred upon mankind.

If we examine into the character of his numerous gifts and the objects he designed to subserve thereby, we find that he acted consistently and in perfect harmony with the sentiment I have indicated, and which governed him in the division and varied dispensation of his exceeding wealth.

Whatever may have been his idiosyncracies, his varying moods of temper, his mind was clear and logical as to how or in what manner his fortune could be best apportioned, and it was bestowed thoughtfully and in pursuance of long cherished convictions. He loved his country, and the sentiment of patriotism incited him to dedicate a portion of his means to the perpetuation, by a monument, of the memory of the author of "The Star Spangled Banner." He was proud of his adopted State and city, hence his gift for a group of statuary illustrative of the settlement and growth of California. He was, during a portion of his life a mechanic, hence the endowment for a school of instruction in the mechanical arts and his gift to the Mechanics' Institute. Himself one of the earliest settlers in the State, he cherished the Society of California Pioneers, and made it and them participants in his bounty. With a high regard for Science and a warm friendship for our Society, he remembered the dubious days in its history; he was familiar with our embarrassments, and not unmindful of our poverty; he had witnessed our "struggle for existence," and gave us with a generous hand.

So, to the University of California, in which he has endowed an Astronomical Department, which is to bear his name, with a princely gift of the value of nearly three quarters of a million of dollars. And so on through the long list of his benefactions we find maturity of design, and a sagacity in the selection of

beneficiaries, which indicate a clear head and an enlarged and generous purpose. A great writer has said:

> "The evil which men do lives after them;
> The good is oft interred with their bones."

This is no unmeaning platitude, but it can be said in truth that it does not apply to him of whom we are speaking.

It may be said by some that our late member, in the bestowal of his gifts, was governed by a common weakness, the desire to perpetuate his name. Concede this, and what then? Is this unnatural, or is this an exceptional case? It is safe to say that the world will readily forgive a vanity which exhibits so noble a form of expression. It is equally safe to assert that the name of James Lick deserves and will receive an honorable place on the roll of great public benefactors; and that those who succeed us in the affairs of this Academy, and who will be especially benefited by the means and facilities for scientific research through the considerate bounty of James Lick, and who will thereby be enabled to contribute something to "the sum of human knowledge," will ever hold his name in grateful remembrance.

The following resolutions, offered by Mr. Stearns, were adopted:

Resolved, That the members of the California Academy of Sciences have learned of the death of their fellow member, friend and benefactor, James Lick, and will ever hold his name in grateful remembrance.

Resolved, That the Academy of Sciences accepts the invitation of the Society of California Pioneers, and will attend the funeral in a body; and it is further

Resolved, That a suitable record of the death of James Lick be entered in the minutes and published in the proceedings, and that the Academy do now adjourn, without transacting further business.

In Memory of

James Lick.

Regular Meeting, October 16th, 1876.

Dr. Blake in the Chair.

Donations to the Museum: From C. F. Kirchner, specimen of silver ore; from G. A. Treadwell, variegated copper ore, from Mexico; from Dr. J. L. Ord, three specimens of Monterey marble; from C. D. Gibbes, specimens of coal, gypsum, conglomerate, terra alba, gum demar, catechu and chrome iron; from Henry Edwards, specimen of serpentine; from J. W. Glass, two specimens of quartz containing asbestos, also specimen of cat's-eye; from Wm. McGillwray, Indian mortar and pestle from Big Panoche Valley; from R. H. Stretch, a cabinet containing about 600 specimens of minerals.

A special vote of thanks was given to Mr. Stretch for his fine donation.

Pacific Coast Lepidoptera.—No. 18. Description of a New Species of Heterocampa (Larva and Imago).

BY HENRY EDWARDS.

The following interesting species was detected by me in the fall of last year, feeding upon willows, in the neighborhood of Mt. Shasta, making the second of the genus now known to inhabit California:

Heterocampa salicis, n. sp. Hy. Edwards.

Larva, Mature. Ground color, bright golden yellow with subdorsal, longitudinal bands of clear white. Head, bright vermillion red, rather small, grooved in centre, with a small fovea in front. Second, third, and fourth segments, with broken black lines, those on the sides occasionally edged with white, each segment with two long spinous tubercles. Fifth segment, bright vermillion red, much swollen dorsally, and bearing eight spinous tubercles. The remaining segments are all striped longitudinally with slightly waved black lines, broken up on the sides into a series of dots. Anal segment, with ten warty spinous tubercles, without white, and all the lines obsolete. Feet and legs, yellow, spotted with black. Mouth parts, black. Spiracles very small, black. Each of the warty tubercles is furnished with a single dirty white hair.

Length, 1.25 inch.

Six caterpillars taken, all feeding close together, upon a dwarf willow, their brilliant colors giving to the plant at a little distance the appearance of a raceme of showy flowers. In a few days they began to undergo their change, and by the 27th of August had all transformed. The cocoon is formed of very close, fine, glossy silk, the leaves of the plant being drawn around it so as to conceal it entirely. It is almost egg-shaped, and very symmetrical.

Chrysalis. Short, broad, bright, chestnut brown, very glossy and shining, the abdominal portion showing the few hairs of the larval tubercles.

Length, 0.65 inch.

The perfect insects began to appear on the 22d of December, a second followed on the 9th of January, and the third on the 16th of March. The remaining specimens all died in the chrysalis state.

Imago. Head and thorax, clothed with dense iron gray hairs, the latter towards the base changing into rich chestnut brown, mottled with fawn-color. Abdomen, stone drab, paler at the base, with the anal tuft fawn-color. Antennæ, with the shaft stone drab, the pectinations yellowish brown.

Primaries. Pale fawn-color, densely clothed with white scales, scattered somewhat irregularly, thickest towards the costal edge, and there forming an imperfect streak. Inner margins, darker, and with rich brown blotches, continued faintly to the posterior angle. At the base of the wings is also a conspicuous, somewhat saggitate patch of the same rich brown color. Fringes, white, mottled with brown. Secondaries, whitish drab, with brown markings near the anterior margin, and a brown blotch near the anal angle.

Underside. Dull whitish drab, shading into brown on the costal edge of both wings. Fringes of primaries, mottled with brown; of secondaries, pure white.

Expanse of wings, 1.55 inch.

This species differs considerably from its congener (*Het. conspecta*, Hy. Edw., Proc. Cal. Ac. Sci., Sept., 1874) in its more irregular markings, in the absence of any defined bands or spots, and in the darker base of the primaries. Both species appear to be rare, and are as yet known only by the specimens in my collection.

Dr. James Blake read the following paper on

Remedy for the Phylloxera.

My attention having been directed some months ago to this new pest which so seriously threatens the destruction of our vineyards, a series of experiments was undertaken under my direction at one of our largest vineyards in Sonoma County, with the view of discovering some means of checking the progress of the disease, as it has already almost destroyed some of the most promising vineyards in that locality. At the time of commencing my investigations I was aware that the subject had occupied the attention of some of the most distinguished scientists in France for the last three or four years, nor should

I have entered on the investigations with any hope of success had I not known that the efforts of these gentlemen seem to have been directed to the destruction of the insect without having acquired sufficient knowledge of its natural history. So far as known, the insect is one which goes through a series of generations without changing its form, during which many thousands of insects can be produced from a single impregnated ovum (75,000,000 have been calculated), but after a certain number of these parthenogenic generations of the power of non-sexual reproduction ceases, and the development of a new form becomes necessary for the continuation of the species. This alternation of generations takes place in many of the lower tribes of animals; the different generations of the same animal being in some instances so dissimilar as to have been mistaken for different species. In the phylloxera the forms usually met with, or, at least, that had been described when I commenced my investigations, were two non-sexual forms, the nymphs and nurses, the former being a small insect with legs which allow a certain degree of locomotion, the latter being a form in which the legs are so slightly developed as to be hardly visible, so that the insect can move but a very short distance from the spot where the ovum is deposited. Besides these two non-sexual forms, whose life is entirely subterranean, there is a winged form in which the two sexes are developed, and which passes the greater part of its existence above ground. Within the last few months it has been discovered that this winged insect deposits its eggs on the leaves and bark of the vine, and from these eggs it is probable that a new generation of nurses and nymphs arises which, at least for many generations, propagate themselves on the roots of the vine without any males being produced. There were two important questions relating to this winged form of the insect which had not been decided—namely, whether they deposit any eggs on the root or bark of the vine under ground, and the form of the insect that is first produced from the impregnated ovum. These questions have an important bearing on the means to be taken for the destruction of the insect, but unfortunately neither of them had received a satisfactory answer. In the spring of this year I presented some specimens at the Microscopical Society, of a form of the insect that had not been described. In my frequent examination of the roots of diseased vines during the winter, the insect was only met with under the form of nurses, which remained in a dormant state from the beginning of November to April. The first sign of a renewal of activity in the insect was the appearance of a form much resembling the nymph but rather larger, with a sort of gelatinous body, and so transparent that from ten to twenty ova could readily be distinguished in the abdomen. It was much more active than the nymphs, running about the roots with agility. My own opinion is, that it was a form of insect directly developed from the impregnated ovum, but whether it had been hatched above the ground and had traveled down on the root, or whether any impregnated eggs had been deposited beneath the surface from which it had been produced, is not known. The same form of insect was described by Mr. Balbiani at a meeting of Academie des Sciences at Paris, about two weeks after I had exhibited it at the Microscopical Society. On seeing this form of the insect, the idea at once struck me that this was the phase of its existence in which it could

most readily be destroyed, and believing that this form was one which was necessary for the continuation of the species, its destruction would necessarily be followed by the disappearance of all the other forms.

The bisulphide of carbon seemed to present the only agent likely to be efficacious against the insect. Owing to the extreme volatility of this substance, its vapor, when it is introduced at some distance beneath the surface, would permeate the earth in all directions over a considerable area, and thus would have a chance of reaching even the distant rootlets of the vine. Although it had been reported in France that the substance was not destructive to the insect, yet I believed that the soft, apparently nude form, which I had just discovered, would not resist it. In order to introduce the substance beneath the ground, an iron tube was taken with a sharp steel point at one end, the sides being pierced with a few small holes near the bottom, and a piston was made which could be forced down the tube. The tube was driven into the earth for a distance of one or two feet, near the root of the vine; some bisulphide of carbon was poured into the tube, which was then filled with water, and the contents of the tube forced out into the ground with the piston. The tube was then drawn out and the hole filled up. The quantity used on each vine was about an ounce and a half of the bisulphide. This was introduced into the ground through two or three holes. The substance was applied in the end of April and early part of May, only one application being made, and in every instance to plants that were evidently suffering from the disease. The result has been, on the vines so treated the insect has almost entirely disappeared, while on vines that were in the same condition last year as those to which the bisulphide had been applied, but which were not treated, the roots swarm with the insect, so that none of them are likely to survive this season, at least of those that were most affected. In the early part of the season no great difference was noticed between the foliage of the vines that had been treated and the others, but within the last six weeks the vines on which the insect had been destroyed present a decidedly healthier appearance. A more marked difference is observable in the roots, specimens of which I submit for inspection. It will be seen that while the roots of the vines to which the bisulphide has been applied present a comparatively smooth and healthy appearance, the roots of the untreated vines are rough and covered with dead and decaying bark. In both sets of roots the lower portion is generally dead, the result of the ravages of the insect during the last season; but while in the plants which are still infested with the insect this process is still going on and will continue until the vine is destroyed, the other roots are throwing out quite a number of healthy rootlets and are covered with a new and smooth bark, so that they will be prepared in the ensuing year to throw out a new crop of rootlets.

As regards the practicability of the treatment this presents no obstacle, as the bisulphide of carbon can be obtained now in a comparatively pure state at fifty cents per pound; and I am confident it can be produced in a form quite suitable for use in the vineyard at a third of the price, so that the cost of the material for each vine would not exceed two or three cents. The process of applying it is simple, and can be carried out by any ordinary laborer. The

time for applying it should be during the month of April, as at this season the insects that have survived the winter have not begun to lay their eggs, and experiments that have been carried on during the summer show that while the bisulphide is a certain poison to the insect in all its forms it does not destroy the egg. This is the reason of its reported failure in France, where probably it was not applied at the right season. By using it in the spring, at the time that the winter eggs at the surface are being hatched and before the hybernating form has commenced laying, we have the insect entirely in that phase of its existence in which it can be killed by the bisulphide; and experience has shown that at this time its destruction is completed by one application of the poison. The only place where the insect has been found on some few of the vines treated has been near the surface, where the vapor became too much diluted with the air to prove fatal, and one patch of the insect was found at a depth of more than four feet, where it was possible the vapor had not penetrated. In the course of my experiments I have discovered that the refuse lime from the gas works will kill the insect for some distance beneath the surface when it has been applied round the roots, and from what we know of the natural history of the insect it is almost certain that it will shortly die out at any great depth, when it cannot be renewed by fresh nymphs developed from the winter ova. The plan of treatment I have advised for the diseased vines is, during the winter, and as late as possible before the cessation of the rains, to apply three or four pounds of the lime refuse round the stem, drawing the earth away from the stem to the depth of two or three inches, at the same time brushing the stem for six or eight inches above the ground with train oil. Then about the middle of April to the first week in May use the bisulphide of carbon under ground in the way I have pointed out, making three holes round each vine at a distance of eighteen inches from the stem, and using about two-thirds of an ounce to each hole, the holes when the tube is withdrawn being well filled with earth and stamped down.

When the vine is so far diseased as to have suffered materially in its foliage, the better plan is, I think, to pull it up. But a careful examination will detect the presence of the insect on the roots of vines the foliage of which appears quite healthy and which are bearing a full crop of fruit. In this stage of the disease the insect is not in sufficient numbers to so completely absorb the descending sap as to have prevented the formation of new rootlets, and while this is the case the vine can readily recover itself. Whatever may be the case in other countries, I am convinced that here the destruction of the lower portion of the roots is not caused by the direct attack of the insect, as I have found the roots dead two or three feet beyond where any traces of the insect could be discovered. Owing to the peculiarities of our climate, the vines send their roots much deeper here than in Europe, and although in the older vines in the vineyard where I investigated the disease the roots derived their principal supply of nourishment at depths from six to ten feet, I have not found the phylloxera at a greater depth than four feet, although the roots were dead as far as they could be traced, and far beyond any part that had been directly attacked by the insect. Where the vines are pretty badly diseased, I think the application of the bisulphide at the beginning of the winter,

say in November, would more than repay the expense, as thousands of insects would be thus destroyed that otherwise would be feeding on the juices of the vine during the next five months. This, however, must not supersede the use of the poison in the spring at the time when the winter eggs are developed.

In the roots shown this evening the healthy appearance of the new rootlets on the treated vines is a sufficient proof of the absence of the phylloxera, although I would state that after a careful examination I have not detected a single insect. The roots that were not treated have not thrown out a single rootlet. It is needless to remark that the vines that were treated all showed evidences of being attacked by the disease last season, as is evident from the appearance of the roots, although not an insect is to be found on them at present.

Where the vines have not been already attacked, I believe the application of train oil to the stem and the gas works lime to the surface round the top of the root will protect them, or a small quantity of the bisulphide introduced near the root a few inches beneath the surface in the spring, would certainly save them from the attack of the insect.

Mr. Guerin read a paper on the Factor of Safety in Water Pipes.

Regular Meeting, November 3d, 1876.

Dr. Stout in the Chair.

Ten members present.

L. A. Scowden was proposed for resident membership.

Donations to the Museum: From W. J. Fisher, specimens of *centropomus*, trachynotus pampanus, octopus, 22 birds and 110 shells; from J. M. Dore, specimen of echeneus maceatus; from Henry Edwards, two fish—one mineral and slab containing fossil; from John Torrence, California gopher.

The President transmitted to the Academy a short paper, dated October 12th, upon the recent search for Vulcan. LeVerrier's telegraphic dispatch asked observers upon the Pacific Coast to make search for Vulcan on the 9th and 10th of October. Professor Davidson was then stationed at the U. S. Coast Survey trigonometrical station, Mt. Helena, at an elevation of 4343 feet above the sea, and had been systematically observing the sun for sun spots and planet from the 6th of October. On the 9th and 10th the disc of the sun was very carefully and frequently examined with a good telescope of three inches aperture and a magnifying power of 85, adjusted for the determination of position of any object on the Sun's surface. Especial care was given to the afternoon hours when the sun was below the horizon to the eastern observatories. Late in the afternoon of the 10th two small spots were discovered, and from their size and want of definiteness it is safe to say that any well defined dark object having a diameter of ten seconds of arc would have been readily detected.

Professor Davidson states that his examination of the sun's disc before the request of LeVerrier was made known, arose from tentative studies which he had been making upon the action of Mercury, Venus, Earth and Jupiter, (together with a probable intra-mercurial planet,) upon the fluid surface of the sun in not only changing its form and causing solar spots, but in the almost infinitesimal reactionary effect of the very slightly distorted form upon the planets, and especially upon the yet unexplained variation of the earth's rotational velocity, which he surmises may have a period of about forty years.

A description of a fish caught at Port Madison, W. T., was submitted by Ferdinand Westdahl, through Prof. Geo. Davidson.

Pacific Coast Lepidoptera.—No. 19. Notes on a Singular Variety of the Larva of Halesidota Agassizii. Packd.

BY HENRY EDWARDS.

It has generally been conceded by entomologists that variation of certain characters in either of the stages of insect life, so long as that variation is contained within what has been called the "well defined limits of a species," does not constitute a ground for founding new species upon trivial differences. But *remarkable* changes in the larvæ of certain forms are decidedly the groundwork upon which other ideas may arise, and are the beacons which light us to a better understanding of the laws which govern the many developments of animal life, which, with their almost countless variations, lead us to the conclusion that our positive knowledge of what really constitutes a species is very limited in extent, and compel us to the confession that we can say but little as to where a species is true to its original type, or how far its wanderings may extend. It is a singular fact that the genus *Halesidota* should present two kindred instances of the variation of the larval stage to such an extent as almost to warrant the assumption that new species had in these cases begun to assert their existence; but it is nevertheless so, the one to which I am about to refer being even more remarkable than that spoken of by the late Mr. B. D. Walsh, in Proc. Boston Soc. Nat. Hist., Feb., 1864, and further alluded to by him in the Proc. Ent. Soc., Phil., Nov., of the same year. To those who are not familiar with Mr. Walsh's papers, it may be briefly stated that he found feeding upon oak some larvæ of this genus, differing very much, both in color and in the arrangement of the pencils of hairs, from those of the well known Atlantic species, *H. tessellaris*, but which, upon arriving at their perfect state, could not possiby be distinguished from the imagos of that species. Mr. Walsh, regarding the larval condition as of equal value with the subsequently matured form, called his new discovery by the name of *H. Antiphola*, and always referred to it as a phytophagic species, and not a phytophagic variety. Mr. Grote, on the other hand, in Proc. Ent. Soc., Phil., December, 1864, alludes somewhat slightingly to Mr. Walsh's experiments, and considers the *Antiphola* of the latter author as merely an accidental variety of the better known and more abundant form; and this, it is but fair to say, is the conclusion arrived at by most other entomologists. It gives me great pleasure to be able to add some few facts bearing upon this interesting question, and to present the description of some larvæ, which, at the time of their capture, certainly appeared to me to be those of a totally new and undescribed species, but which, in their imago condition, can in no possible character be distinguished from the well known California species, *H. Agassizii* of Packard,=*Phægoptera salicis*, Bois. My specimens were taken by myself in August, 1865, in Strawberry Valley, near Mount Shasta, one of them feeding upon alder (*Alnus viridis*), and the other upon a species of willow. For the better comparison of the singular

differences in the larvæ, I subjoin, in parallel columns, the description of both:

Hal. Agassizii.

Head, body and prolegs, entirely black. Abdominal legs, dirty yellow. Body, slightly depressed, with the three anterior and three posterior segments evenly clothed with velvety black hairs, out of which spring some pencils of white hairs, much longer than the general clothing of the body. The middle segments are clothed with very bright lemon yellow hairs, with a black lozenge-shaped patch in the middle of each segment. In some specimens the yellow extends further, both anteriorly and posteriorly, the black hairs being consequently less; but there is little or no change during the growth of the larva, save in size, the colors being quite similar through the successive moults.

Hal. Agassizii. Var. *Alni.* Hy. Edw.

Color of body, cream white, except the head, which is jet black. Bundles of hair of the same form and arrangement as in *H. Agassizii*, but wholly of a beautiful cream white, concolorous with the body of the caterpillar. Down the middle of the dorsal region, is a row of oblong, bright red, almost vermillion, lozenge shaped bundles of hair, wanting on first, second, third and anal segments.

Length, 1.00 inch.

Previous to the last moult, the caterpillars became very dull in color, and the subsequent condition was seen through the larval skin prior to its exclusion. The appearance then presented was much closer to the usual form of *H. Agassizii*, but with a few striking differences. The body was now wholly slate black. Head, jet black, shining. Mouth parts, black, with a streak of cream color above them. 2d, 3d, 4th, 5th, 9th, 10th, 11th, 12th and 13th segments, as in *H. Agassizii*, clothed with jet black hairs, with long white pencils interspersed. The middle segments, that is, the 6th, 7th and 8th, are bright golden, and not lemon yellow, without any black hairs whatever. Thoracic legs, black; abdominal, dull yellow.

It will thus be seen that the great difference of these larval forms consists in the stages previous to the last moult, the typical one being then lemon yellow, with black extremities, and black dorsal hairs, while the other is cream white, with vermillion dorsal hairs. Moreover, the last moult of my new variety is apparently specifically different from the normal form, the yellow being a much deeper and richer tint, and the black bunches of dorsal hairs being utterly wanting. It may be well to state that *H. Agassizii* feeds exclusively upon willows, whereas my Shasta examples thrived equally upon willow and alder.

They were found on the 17th of August, changed from the white and red stage on the 26th, and spun their cocoons on the 14th and 16th of September. In this condition there was no appreciable difference, except that the golden hairs gave rather a richer appearance to the cocoon. The moths emerged on the 1st and the 15th of March, both being females, and presenting, as I have said, no points of distinction from the ordinary coloring and markings of the typical species. For the sake of reference, I propose for this variety the name of *Hal. Alni*.

REGULAR MEETING, NOVEMBER 20TH, 1876.

Vice-President Edwards in the Chair.

Nineteen members present.

Donations to the Museum: From G. A. Treadwell, specimen of inetacinnatarite, Lake County, Cal.; from Henry Edwarus, silver ore and fossils from White Pine, Nev.; from C. D. Gibbes, stamp copper and fine copper, Penabic mine, Michigan; fossil shells, Fresno County, Cal.; sandstone and infusorial earth from same place; petroleum from Gibbes' oil spring, with samples of burning and lubricating oils, Fresno County; asphaltum from naptha oil springs, Kern County, Cal.; from G. Yale Gay, lussite, from Soda Lake, Churchill County, Nev., also manufactured product; from C. L. Scudder, Arizona rubies; from Mrs. Elizabeth Bush, San José, 40 specimens of copper ore, 20 specimens sulphuret of iron, and sulphurets of zinc, from Buchanan copper mine, Fresno County, Cal.; 20 specimens andaluriate crystals from near Buchanan mine; 23 specimens crystals of calcite anceforsil shells, from Penitensia Cañon, Santa Clara County, Cal.; three specimens rock from Black Spring, Penitencia Cañon; three specimens of sandstone; two specimens of conglomerate, containing andalusite crystal; 13 crystals (California diamonds), Lake County, Cal.; fibre of milk weed, Fresno County; one pine and two spruce cones from Glen Falls, N. Y.; from Asa T. Hayden, Honolulu, land shells and fresh-water shrimps from the inormtum streams.

Mr. Lockington described a species of lizard from Lower California.

Dr. Kellogg read the following paper:

On a recent visit to Mendocino County, Mr. Joseph H. Clarke, our corresponding member and enterprising collector and contributor in several departments of natural history, gave some plants, and among them is found a new species of *Isopyrum*, which it is proposed to name in his honor.

Isopyrum Clarkii. K.

Stem simple, filiform, glabrous—rarely more than one—1-3 inches high, 1-flowered; root, a fasiculus of oblong sessile tuberlets; leaves biternate, radicle leaf on a long slender petiole, the leaf or leaves about equaling the stem, rarely exceeding it. Cauline relatively shorter, stipules minute, petiolules very short, leaflets broadly obconic, 2-3 cleft lobed segments oblong, obtuse, mucronate, base cuneate, about 2-3 lines long and 1 broad, somewhat glaucous beneath; flowers on long filiform terminal peduncles, white, 4-lines in diameter; sepals oblong-obovate, subobtuse; stamens 9-10, filaments lance-linear, flattened, somewhat petaloid—not dilated above—two-thirds the length of sepals; folicular ovaries 5-6, oblong, flattened, about 3-seeded, on stipes one-third their length. Differs from *I. occidentale* in its size and simple 1-flowered character, pods stipitate, 3-4 seeded, and more distinctly separate stipules; the roots also are not the thickened fibres of that species, but true ablong little tubers. Growing among mosses.

The following plant of Mr. W. J. Fisher's collection at San Diego, is so rare—if not altogether new—it is proposed to make it known provisionally as a variety of Dr. Gray's.

Actinolepis mutica. var.

Stem erect, simple, oppositely branching above into a loose somewhat corymbose spreading top, canescently villous, with short glandular hairs throughout, more or less mixed with long simple hairs above; leaves opposite (upper sessile), 1-2 inches long, pinnatifid, filiform, or narrowly linear lobes from a somewhat broadened rachis, or margined petiole, rather palmately multifid as reduced on the branches; peduncles slender, 2-3 times the length of the leaves or 1-2 inches long, solitary and terminal, a few from the upper axils, involucre broadly bell-shaped, scales about 12, or same number as the rays, acute tips hispid and glandular somewhat recurved, loosely appressed carinated to the middle; rays longer than the scales; akenes linear-cuneate, black, minutely scabrulose, of the ray incurved; pappus very minute, about 5-8, obtuse, laciniated membranous or hyaline scales; receptacle sharply conic finely pappillose-pubescent; disk florets yellow, glandular, tips of the teeth bearded on the back and nerves each side of the sinuses often produced into minute spines; branches of the style tipped by a short naked cone.

C. D. Gibbes read a paper describing the geological formation of the oil region in Tulare Valley, west of Tulare Lake, exhibiting also specimens of the oils and rocks.

A paper was submitted, through Dr. Kellogg, by Prof. G. Eisen, entitled, "A preliminary report on the Lithobre of North America."

Lithobioidæ Americæ Borealis.

Preliminary Report on the Lithobii of North America.

BY ANTON STUXBERG.

The oldest account, as far as I know, of the occurrence of Lithobii in North America is dated about fifty years ago, when Thomas Say, in the year 1821, in his "Descriptions of the Myriapoda of the United States," (Journal of the Academy of Natural Sciences of Philadelphia, 1st series, vol. 2, pp. 102–114) described a species found in the vicinity of Philadelphia, under the name of *Lithobius spinipes*.

Next to Say comes George Newport, who (1845) in his classical work "Monograph of the class Myriapoda, order chilopoda," (Transactions of the Linnean Society, vol. XIX, pp. 265—302, 349—439,) described as being found in the United States, three species: *Lithobius multidentatus*, *L. Americanus* and *L. planus*; of these Newport considers, however, not without some doubt, *L. Americanus* to be identical with *L. spinipes*—Say; and according to my opinion this same *L. Americanus* is no other species than the one in Europe so exceedingly common, and well known since the time of Linneus, as *L. forficatus* (Linneus), not to mention a very short communication by Perbosc in Revue Zoölogique, 1839, page 261, where a supposed new species *L. Mexicanus* is very unsatisfactorily described.

When Ludwig Koch, in the year 1862, published his monographic treatise on the genus Lithobius (Die Myriapodengattung Lithobius, Nümberg, 1862,) he also described as new two North American species: *L. transmarinus* and *L. mordax*.

Shortly afterwards, 1863, we find by Horatio C. Wood, Jr., under the title: "On the chilopoda of North America, with a catalogue of all the specimens in the collection of the Smithsonian Institution," (Journal of the Academy of Natural Sciences of Philadelphia, new series, vol. V, pp. 5–52,) the beginning of a monograph of the myriopods of North America. Of Lithobii he enumerates not less than seven species: *L. multidentatus*, *L. Americanus*, *L. paucidens*, *L. planus*, *L. nobilis*, *L. Xanti*, and *L. bipunctatus*, of which the three last mentioned are arranged under a separate Genus *Bothropolys*, distinguished from the old genus *Lithobius* Leach, by the arrangement of pori coxales in several more or less irregular rows.

In his principal work of somewhat later date, (1865), "The Myriapoda of N. America," (Transactions of the American Philosophical Society, new

series, vol. XIII, pp. 137-248,) he however, after continued study and with access to the necessary material, somewhat modified his former ideas of the N. American Lithobii, as can be seen by a comparison between the species mentioned in his two different works of the years 1865 and 1863.

(Genus LITHOBIUS, Wood.)

1865.		1863.
L. Americanus	=	{ *L. multidentatus.* *L. Americanus.*
L. transmarinus.		
L. mordax.		
L. paucidens	=	*L. paucidens.*
L. planus	=	*L. planus.*

(Genus BOTHROPOLYS, Wood.)

B. multidentatus	=	*B. nobilis.*
B. Xanti	=	*B. Xanti.*
B. bipunctatus	=	*B. bipunctatus.*

Two years later or in 1867, we find mentioned also by Wood another species *L. bilabiatus*, from Illinois, "Notes on a collection of California Myriapoda, with the description of new eastern species," (Proced. Acad. Nat. Science of Philada. 1867, pp. 127-130.)

Finally, during the last years, the following species of Lithobii not previously known have been added to our knowledge of the myriapod fauna of North America:

(*a.*) Of Alois Furnbert and H. de Saussure, 1869, ("Myriapoda Nord Americana." Revue et Magasin de Zoologie, 2:me série, vol. XXI, pp. 149-159.) *L. aztecus*, *L. mystecus* and *L. toltecus*, all from Mexico.

(*b.*) Of Fr. Meinert, 1872, ("Myriapoda Musei trauniengis, II Lithobiini:" Nat. Tidsskrift, 3:R., 8:Bind, pp. 281-344) *L. vorax*, from Louisiana.

(*c.*) Of O. Harger, 1872, ("Descriptions of New N. American Myriopods:" Am. Journal of Sc. and Art, 3d series, vol. IV, pp. 117-121,) *L. pinetorum*, from Oregon; and lastly

(*d.*) By the author of this paper, 1875 ("Nya N. Americanska Lithobier"—Ofvers. Kgl. Vet. Acad., Fish. aig 32 pp., 65-72). *L. monticola*, *L. pusio*, *L. paradoxus*, *L. obesus*, *L. kochii*, *L. megaloporus*, *L. cnemis*, *L. saussurei* and *Lamyctes fulvicornis*.

Such is, in short, the historical development of our knowledge of the Lithobii of the N. American continent. Their number—very small, certainly, in comparison with what is known from Europe—does not exceed twenty-four, considering *L. spinipes*, Say, to be identical with *L. americanus*, Newport. The following is an abstract from a more extensive work, now in preparation, a preliminary report with synonymy of all hitherto known species.

Of the following species I know personally fourteen, or 2, 3, 5, 7, 8, 10, 13, 14, 16, 18, 19, 20, 21, 24. A very rich material, carefully collected and pre-

served, has been remitted to me by Gustaf Eisen, now in San Francisco; but besides I have also had the opportunity to receive valuable contributions from H. de Saussure in Geneva, and Fr. Meinert in Copenhagen.

Gen. I. LITHOBIUS Leach 1815. (Trans. Linn. Society, vol. XI, p. 381.)
Subgen. I. EULITHOBIUS Stuxberg 1875. (Ofvers Kgl. Vet.-Akad:ns Förhandl., arg. 32 N:o 3 pag. 8.)

Santa Sorsualia, 6, 7, 9, 11, 13 *angulis porticis productis.*
Poricoxales in pedum paribus 12, 13, 14, 15.

1. EULITHOBIUS MULTIDENTATUS Newport 1845.

Syn. 1845. *Lithobius multidentatus* Newport, Trans. Linn. Society, vol. XIX, pag. 365.
1847. " " Gervais, Hist. Nat. d. Insectes Aptères, vol. IV, pag. 236.
1856. " " Newport, Catalogue of the Myriapoda, pag. 17.
1863. *Bothropolys nobilis* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 15.
1865. " *multidentatus* Wood, Transact. Americ. Philos. Society, new series, vol. XIII, pag. 152.

Hab. in civitatibus orientalibus, ex. gr. Pennsylvania, Illinois, Missouri (sec. Wood).

Subgen. I. NEOLITHOBIUS Stuxberg 1875. (l. c., pag. 8.)

Scuta dorsualia, 7, 9, 11, 13 *angulis posticis productis.*
Pori coxales in pedum paribus, 12, 13, 14, 15.

2. NEOLITHOBIUS vorax Meinert 1872.

Syn. 1872. *Lithobius vorax* Meinert, Naturhist. Tidsskrift, 3:dje Række 8:de Bind, pag. 292.

Hab. in Louisiana circa Beloxi haud procul ab New Orleans (sec. Meinert).

3. NEOLITHOBIUS mordax L. Koch 1862.

Syn. 1862. *Lithobius mordax* L. Koch, Die Myriapodengattung Lithobius, pag. 34.
1872. " " Meinert, Naturhist, Tidsskrift, 3:dje Række, 8:de Bind, pag. 294.

Hab. circa New Orleans (sec. Koch et Meinert).

4. NEOLITHOBIUS TRANSMARINUS L. Koch 1862.

Syn. 1862. *Lithobius transmarinus* L. Koch, Die Myriapodengattung Lithobius, pag. 33.

Hab. circa New Orleans (sec. Koch).

Subgen. III. LITHOBIUS [Leach] Stuxberg 1875. (Ofvers Kgl. Vet.-Akad:ns Förhandl., årg. 32 N:o 3, pag. 8.)

Scuta dorsualia 9, 11, 13, *angulis posticis productis.*
Pori coxales in pedum paribus 12, 13, 14, 15.

5. Lithobius Xanti Wood 1863.

Syn. 1863. *Lithobius Xanti* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 15.
1872. " *rugosus* Meinert, Naturhist, Tidsskrift, 3:dje Række, 8:de Bind, pag. 306.
Hab. in California, Oregon, cet.

6. Lithobius planus Newport 1845.

Syn. 1845. *Lithobius planus* Newport, Transact. Linn. Society, vol. XIX, pag. 366.
1847. " " Gervais, Hist. Nat. des Insectes Aptères, vol. IV, pag. 236.
1856. " " Newport, Catalogue of the Myriapoda, pag. 18.
1863. " " Wood, Journ. Acad. Nat. Sci. Philadelphia,-new series, vol. V, pag. 14.
1865. " " Wood, Transact. Americ. Philosophical Society, new series, vol. XIII, pag. 151.
Hab.—?

7. Lithobius Saussurei Stuxberg 1875.

Syn. 1875. *Lithobius Saussurei* Stuxberg, Ofvers Kgl. Vet.-Akad:ns Förhandl., årg. 32 N:o 2, pag. 71.
Hab. in Mexico (H. de Saussure).

8. Lithobius forficatus Linné 1758.

Syn. 1758. *Scolopendra forficata* Linné, Syst. Nat., ed. X, vol. I, pag. 638.
1778. " " De Geer, Mém. p. servir à l'hist. des Insectes, vol. VII, pag. 557, tab. 25, figg. 1–6.
1815. *Lithobius forficatus* Leach, Transact. Linn. Society, vol. XI, pag. –
1815. " *vulgaris* Leach, Ibidem, pag. 382.
1815. " *lœvilabrum* Leach, Ibidem, pag. 382.
1821. " *spinipes* Say, Journ. Acad. Nat. Sci. Philadelphia, vol. II, pag. 108.
1842. " " Lucas, Hist. Nat. d. Crust., d. Arachn. et d. Myriapodes, pag. 543.
1844. " *forficatus* C. Koch, Deutschl. Crust., Myriap. und Arachniden, Heft 40, tab. 20.
1845. " *americanus* Newport, Trans. Linn. Society, vol. XIX. pag. 365, tab. XXXIII, fig. 29.
1845. " *forficatus* Newport, Ibidem, pag. 367.
1845. " *Leachii* Newport, Ibidem, pag. 368.
1847. " *forcipatus* Gervais, Hist. Nat. d. Insectes Aptères, vol. IV, pag 229.
1847. " *americanus* Gervais, Ibidem, pag. 236.
1856. " " Newport, Catalogue of the Myriapoda, pag. 17.

Syn. 1856.	"	*forficatus*	Newport, Ibidem, pag. 18.
1856.	"	*Leachii*	Newport, Ibidem, pag. 19.
1862.	"	*forficatus*	L. Koch, Die Myriapodengattung Lithobius, pag. 39.
1862.	"	*hortensis*	L. Koch, Ibidem, pag. 45.
1862.	"	*coriaceus*	L. Koch, Ibidem, pag. 51.
1863.	"	*forficatus*	C. Koch, Die Myriapoden, Bd. I, pag. 11?, tab. 52, fig. 104.
1863.	"	*multidentatus*	Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 13.
1863.	"	*americanus*	Wood, Ibidem, pag. 14.
1865.	"	"	Wood, Trans. Americ. Philos. Society, new series, vol. XIII, pag. 148.
1866.	"	*forficatus*	Palmberg, Sveriges Myriapoder Ordn. Chilopoda, pag. 15.
1866.	"	*hortensis*	Palmberg, Ibidem, pag. 17.
1868.	"	*curtirostris*	Eisen & Stuxberg, Ofvers. Kgl. Vet.-Akad:ns Förhandl., årg. 25, pag. 376.
1869.	"	*forficatus*	Meinert, Naturhist, Tidsskrift, 3:dje Række 8:de Bind, pag. 259.
1869.	"	*coriaceus*	Meinert, Ibidem, pag. 260.
1869.	"	"	v. Porath, Ofvers. Kongl. Vet.-Akad:ns Förhandl., årg. 26, pag. 637.
1871.	"	*forficatus*	Stuxberg, arg. 28, pag. 496.
1872.	"	"	Meinert, Naturhist, Tidsskrift, 3:dje Række, 8:de Bind, pag. 315.

Hab. in civitatibus orientalibus, ex. gr. New Foundland (J. Lindahl), New York (G. Eisen), Canada, Illinois, Missouri, Arkansas (sec. Wood).

9. Lithobius Aztecus Humb. and Saussure 1869.

Syn. 1869. *Lithobius aztecus* Humb. and Saussure, Revue et Magazin de Zoologie, 2:me série, vol. XXI, pag. 156.

Hab. in Mexico (sec. Saussure).

10. Lithobius Mystecus Humb. and Saussure 1869.

Syn. 1869. *Lithobius Mystecus* Humb. and Saussure, Revue et Magasin de Zoologie, 2:me série, vol. XXI, pag. 156.

Hab. in Mexico (sec. Saussure).

11. Lithobius paucidens Wood 1863.

Syn. 1863. *Lithobius paucidens* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 14.

1865. " " Wood, Transact. Americ. Philosoph. Society, new series, vol. XIII, pag 151.

Hab. in California circa Fort Tejon (sec. Wood).

12. Lithobius pinetorum Harger 1872.

Syn. 1872. *Lithobius pinetorum* Harger, Americ. Journal of Science and Arts, 3:rd series, vol. IV, pag. 118.

Hab. in Oregon, "in the valley of the John Day River" (sec. Harger).

Subgen. IV. PSEUDOLITHOBIUS Stuxberg 1875. (Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 8.)

Scuta dorsualia 9, 11, 13, *angulis posticis productis.*

Pori coxales in pedum paribus 12, 13, 14, 15.

13. PSEUDOLITHOBIUS MEGALOPORUS Stuxberg 1875.

Syn. 1875. *Lithobius megaloporus* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 2, pag. 69.

Hab. in California ad San Francisco (G. Eisen).

Subgen. V. HEMILITHOBIUS Stuxberg 1875. (Ofvers. Kgl. Vet. Akad:ns Förhandl., arg. 32, N:o 3, pag. 8.)

Scuta dorsualia 11, 13, *angulis posticis productis.*

Pori coxales in pedum paribus 12, 13, 14, 15.

14. HEMILITHOBIUS EUCNEMIS Stuxberg 1875.

Syn. 1875. *Lithobius eucnemis* Stuxberg, Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 14.

Hab. in civitate New York ad Mount Lebanon (G. Eisen).

Subgen. VI. ARCHILITHOBIUS Stuxberg 1875. (Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 8.)

Scuta dorsualia omnia angulis posticis rotundalus vel subrectis.

Pori coxales in pedum paribus 12, 13, 14, 15.

15. ARCHILITHOBIUS BIPUNCTATUS Wood 1863.

Syn. 1863. *Bothropolys bipunctatus* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 16.

1865. " " Wood, Transact. Americ. Philosoph. Society, new series, vol. XIII, pag. 153.

Hab. in California cet. trans Rocky Mountains (sec. Wood).

16. ARCHILITHOBIUS MONTICOLA Stuxberg 1875.

Syn. 1875. *Lithobius monticola* Stuxberg, Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 14.

Hab. in Sierra Nevada (G. Eisen).

17. ARCHILITHOBIUS TOLTECUS Humb. and Saussure 1869.

Syn. 1869. *Lithobius Toltecus* Humb. and Saussure, Revue et Magasin de Zoologie, 2:me série, vol. XIX, pag. 157.

Hab. in Mexico (sec. Saussure).

18. ARCHILITHOBIUS PUSIO Stuxberg 1875.

Syn. 1875. *Lithobius pusio* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Föhandl., arg. 32, N:o 3, pag. 16.

Hab. in California ad San Francisco (G. Eisen).

19. ARCHILITHOBIUS KOCHII Stuxberg 1875.

Syn. 1875. *Lithobius Kochii* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 18.

Hab. in California ad Sauzalito haud procul ab San Francisco (G. Eisen).

20. ARCHILITHOBIUS OBESUS Stuxberg 1875.

Syn. 1875. *Lithobius obesus* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 2, pag. 67.
Hab. in California ad Sauzalito (G. Eisen).

21. ARCHILITHOBIUS PARADOXUS Stuxberg 1875.

Syn. 1875. *Lithobius paradoxus* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 2, pag. 67.
Hab. in California circa urbem San Pedro (G. Eisen).

22. ARCHILITHOBIUS BILABIATUS Wood 1867.

Syn. 1867. *Lithobius bilabiatus* Wood, Proceed. Acad Nat. Sci. Philadelphia, 1867, pag. 130.
Hab. in Illinois (sec. Wood).
[Species incertæ sedis:]

23. LITHOBIUS MEXICANUS Perbosc 1839.

Syn. 1839. *Lithobius mexicanus* Perbosc, Revue Zoologique 1839, pag. 261.
Hab. in Mexico (sec. Perbosc).

Gen. II. LAMYCTES Meinert 1869. (Naturhist. Tidsskrift, 3:dje Række, 5:te Bind, pag. 266.)

24. LAMYCTES FULVICORNIS Meinert 1869.

Syn. 1869. *Lamyctes fulvicornis* Meinert, l. c. pag. 267.
1869. *Lithobius gracilis* v. Porath, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 26, pag. 641.
1871. *Lamyctes fulvicornis* Stuxberg, Ibidem, arg. 28, pag. 504.
1872. " " Meinert, Naturhist. Tidsskrift, 3:dje Række, 8:de Bind, pag. 343.
Hab. in civitate New York ad Mount Lebanon (G. Eisen).

Species Lithobioidarum Americæ Borealis huc usque cognitæ hoc modo distinguendæ.

	Antennæ articulis	Coxæ pedum maxillarium 2:di paris dentibus	Pori coxales (ubi numerosi in series plures irregulares digesti sunt * * * * significantur.)	Pedes 1:mi paris calcaribus	Pedes penultimi unguibus (ungue)	Pedum analium articulus 1:mus calcaribus (calcari)	Pedes anales calcaribus (articulorum 2:di, 3:tii 4:ti, 5:ti)	Pedes anales unguibus (ungue)	Longitudo corporis m. m.
1. Eulithobius multidentatus		12–19							25
2. Neolithobius vorax	40–48	12–14	6, 7, 8, 6–9, 10, 9, 7	2, 2, 1	2	1	1, 3, 3, 1–1, 3, 3, 2	1	20–22
3. " mordax	32–37	12–14	7, 8, 9, 6–8, 10, 11, 6	2, 2, 1	1	0	1, 3, 3, 1–1, 3, 3, 2	1	20–26
4. " transmarinus	38	12	5, 8, 7, 5 6, 8, 7, 5				1, 3, 3, 2		12
5. Lithobius Xanti	20	14–20	* * * *	2, 2, 1	2	2	1, 3, 2, 1–1, 3, 3, 1	1	18–25
6. " planus		14							
7. " Saussurei	27	10	5, 6, 7, 6	2, 3, 2	2	1	1, 3, 3, 1	2	23
8. " forficatus	36–48	10–14	6, 6, 6, 5–12, 10, 9, 8	2, 3, 2	2	0	1, 3, 3, 1–1, 3, 3, 2	1	15–26
9. " Aztecus	30	12							23
10. " Mystecus	36–48	6–8	3, 4, 4, 3	0, 1, 1	2	1	1, 3, 2, 0		13(18)
11. " paucidens		4							25
12. " pinetorum		4–6							15
13. Pseudolithobius megaloporus	19–20	4–6	2, 2, 1, 1, 1	1, 1, 1	2	0	0, 1, 1, 0	1	12
14. Hemilithobius eucnemis	20–(24)	6	4, 5, 5, 4	1, 2, 1	2	1	1, 3, 3, 1	2	13
15. Archilithobius bipunctatus		18	* * * *						25
16. " monticola	20	12	* * * *	2, 3, 2	2	2	1, 4, 3, 1–1, 4, 3, 2	1	18
17. " Toltecus	40	4							12
18. " pusio	20	10	2, 3, 3, 2	1, 1, 1	2	2	1, 3, 2, 0	1	8–9
19. " Kochii	20	4	2, 3, 3, 3	0, 1, 1	2	1	1, 3, 2, 0	2	11
20. " obesus	20	4	2, 3, 3, 3	1, 2, 1	2	1	1, 3, 2, 1	1	13
21. " paradoxus	20	4	1, 2, 2, 2	1, 2, 1	2	0	1, 2, 1, 0	1	11
22. " bilabiatus									
23. Lithobius mexicanus									
24. Lamyctes fulvicornis	24–29	6	2, 2, 3, 2–3, 4, 4, 4	0, 0, 0	3	0	0, 0, 0, 0	3	8–11

Pacific Coast Lepidoptera, No. 20. Notes on the Case-Bearing Moths, (Psychidæ,) with notices of Californian Species.

BY HENRY EDWARDS.

Among the whole of the insect races perhaps there are no more curious and interesting examples than are to be found in the family *Psychidæ*, the species of which, in the early stages of their growth, weave habitations for the caterpillars of fragments of stick, bark, lichens and other vegetable substances, carrying these singular structures about with them through the whole of their larval stage, and, in the case of the female, arriving at maturity, bringing forth her eggs, and eventually dying without once quitting her self-constructed prison. The *Psychidæ* are a portion of the great silk-spinning family of the *Bombycidæ*, but present many characters which are distinct in themselves, and entitle them to rank, as they are now by most entomologists allowed to do, as a separate and well-defined tribe.

Though containing comparatively few genera and species, they have a wide geographical distribution. Examples of the group are to be found in Europe, North and South America, West Indies, Mexico, Ceylon, Northern India, China, South Sea Islands, and Australia, being most abundant in the subtropical regions of the globe. Many of the species are, however, small in size, and it is possible that a very large number yet await the industry of observers.

In the construction of the caterpillar cases, they manifest wonderful ingenuity, and their houses are even more remarkable than those of the well-known caddis-flies among the *Neuroptera*. Pieces of bark, leaves, straws cut to a uniform length, twigs, mosses, lichens and grass, form, among the various species, the outer covering or decoration of the home, while the interior is lined with dense soft silk, the threads of which are also used to bind together the external fragments. Almost as soon as the larva is hatched from the egg, it begins the formation of its case, never quitting its habitation as it enlarges in size, but splitting it at the sides, weaving into the opening portions of the vegetable matter chosen and adding to the exterior larger pieces of stick, straw or leaves, as the case may be. "While the creature is small, and the house of no great weight, it is carried nearly upright, but when it attains size and consequent weight, it lies flat, and is dragged along in that attitude." The abdominal legs are furnished with a series of strong hooks, by which the larva retains so firm a hold of the interior of its tube that it is impossible to remove it without injury. When feeding, only the head and the first three or four segments are protruded, and if the caterpillar wishes to remain quiet, it fastens itself by strong silken threads to the branch on which it may chance to be; these threads, on a desire for removal, being bitten off close to the case.

It has the power of turning round inside of its case, and when full grown,

and about to change to the chrysalis state, it places its head downward, so that when the perfect insect is ready to emerge, it may do so from the posterior portion of the tube. And it may here be said that it is the male alone which escapes from its curious habitation. The female is, in most of the genera, totally unprovided with legs or wings, and is little more than a living bag of eggs, looking, as one author has said, "more like a grub than a moth, the head, thorax and abdomen being hardly distinguishable from each other." Her eggs are laid within the body of the tube, after which operation she dies, the first occupation of the young caterpillars being to consume the body of their mother, "a proceeding almost exceptional in the lepidopterous insects." Having done this, they leave their early home and go forth into the world to follow independent lives.

The males emerge from the chrysalis state in about three weeks, and are dull-looking moths of dark color, generally unattractive in appearance, having the antennæ in some cases deeply pectinated only at the base, and, in others, feathered throughout the whole length. They are remarkably swift in their flight, dashing themselves, in search of the females, wildly among the branches of the trees, and as their wings are delicate in structure, in many species nearly transparent, specimens in good order are very rare in collections.

The typical genus *Psyche* is mostly confined to the Old World, some forty species being there known to naturalists. The most striking examples of the group, however, in which the larva cases are sometimes four or five inches in length, belong to a genus named *Œceticus*, of which a species named *Œceticus Saundersii* is found abundantly in the West Indies, feeding upon fruit trees, and at times causing considerable damage. A closely allied form is common in Sinaloa, Mexico, some of the tubes of which, together with about sixteen species of *Psychidæ* from various portions of the globe, I have the opportunity of exhibiting this evening. I have, however, in my collection many of the cases, the perfect insects of which are unknown to me, and I may here mention that in confinement it is, from some cause or other, almost impossible to bring these creatures to maturity. During my residence in Australia, one species which, in its caterpillar state, was common upon the *Leptospermum lanigerum* (the tea-tree of the colonists), though persistently collected through several years and watched with incessant care, never reached the perfect stage, and to this day the imago is unknown to me. Nor was this due to the attacks of parasitic insects, as the substantial and somewhat formidable looking houses of the larva rendered them almost impervious to the onslaughts of ichneumons and other insect enemies. Death usually occurred after the caterpillar had undergone its change, the chrysalis gradually drying up after assuming its proper form, nor could any care and attention which I was able to bestow avert this misfortune.

Owing to the resemblance which exists between these remarkable insects and the fasces which were borne before the dignitaries of ancient Rome, one species has been termed the lictor-moth, while others are known as house-builders, sack-bearers, basket-carriers, and like appellations. According to the Rev. J. G. Wood, "the Singalese call them by a name which signifies billets of wood, believing that the insects were once human beings who stole

firewood while on earth, and are forced to undergo an appropriate punishment while in the insect state."

The species at present described as natives of the United States are very few, not more than five belonging to perhaps as many genera, being distinctly known to entomologists. The most common of these is a species called *Thyridopteryx ephemeriformis*, which, according to Dr. Harris, is occasionally abundant in Philadelphia and its vicinity, and there popularly known in its larval state as the drop-worm or basket-worm. It is at times very destructive to the arbor-vitæ, larch and hemlock trees. In California, though none as yet have been described, three species are known to me, two of which belong to the typical genus, *Psyche*; the third, and by far the most interesting, which has just been discovered by our President, Prof. Davidson, representing the genus *Œceticus*. It is, however, a matter of regret that at present the caterpillar cases of these three species are alone known, the perfect insects as yet evading our discovery.

Though, perhaps, not quite in order to give names to insects from their earlier stages alone, I am induced to offer brief descriptions of these curious creatures, and to suggest the names appended to them, in the hope that I may, by directing attention to the subject, induce observers in various portions of the State to devote their energies to the discovery, not only of the more mature conditions of the species, already imperfectly known to us, but to the detection of other forms of these most interesting insects.

Psyche fragmentella, n. sp. Hy. Edw.

Chrysalis case about an inch in length, tapering gradually to its posterior extremity, and composed externally of portions of leaves and bark, mostly ovate in shape, and from one to two lines in greatest diameter, in most cases laid flat on the silken web, and not overlapping each other. Chrysalis, pale, tawny, shining, smooth, of uniform thickness throughout.

Length, 0.40 inch.

On trunks of pine trees, Strawberry Valley, Siskiyou County. Hy. Edw.

Psyche coniferella, n. sp. Hy. Edw.

Chrysalis case a little over an inch in length, thickened anteriorly and composed of fragments of the leaves of pine, about three lines in length, laid in rows upon the silken web, and overlapping each other, in the manner of *P. graminella* and other European species. The fragments diminish in length on the posterior layers.

Grass Valley, Cal. On palings and trunks of pine trees. Hy. Edw.

Œceticus Davidsonii, n. sp. Hy. Edw. (See engraving.)

Chrysalis case about one and a half to one and three-fourths inches in length; stout, a little thickened in the middle, and composed of pieces of sticks or twigs from one-third to one and a quarter inches in length, laid side by side longitudinally, one or two pieces nearly always extending posteriorly some distance beyond the termination of the case. The fragments with which the case is covered are of different lengths, and are about fifteen in number, the interstices being filled with wood dust (most probably produced by the jaws of the insect itself), closely woven into the silken groundwork of

Cases of Œceticus Davidsonii, attached to the stem.

1, 2. Chrysalis removed from its case.

(TO FACE PAGE 142.)

the case. The edges of the pieces of wood are always neatly rounded by the insect, and all outstanding branches are bitten off. Chrysalis, with the abdominal portions, light chestnut brown, with the wing cases almost black. It is nearly tubular in form, smooth, with some small hooks on the abdominal segments.

Length, 0.65 inch.

Discovered by Prof. Geo. Davidson on Mt. Diablo, on the branches of *Castaneopsis chrysophylla*, Dougl., (chinquapin chestnut). I have much pleasure in recording this interesting discovery by attaching to the species the name of our respected President.

It will be observed, both in the present species and one closely allied to it from Australia, that there are, as I have shown, in most of the cases, some pieces of twigs longer posteriorly than those of which the remainder of the case is composed. It has struck me that these may be intended as a means to assist the male insect, on arriving at the perfect state, to escape from the body of the tube, the twig affording foothold and enabling the creature to draw its somewhat unusually long abdomen from the aperture. I do not state this as a fact, but the subject is worth the observation of those who may be fortunate enough to have the opportunity. I suspect that the cases containing males only have these lengthened sticks, but if this be so we are utterly at a loss to understand the process by which the creature arrives during the caterpillar stage at a knowledge of its sex, and so frames its habitation accordingly.

Regular Meeting, December 1, 1876.

President in the Chair.

Donations to the Museum: From S. B. Christy, specimen of Molybdenum from Red Jacket Mine.

Professor Davidson read a continuation of his papers on Irrigation, describing the North Sea Canal of Holland.

Pacific Coast Lepidoptera, No. 21.-Descriptions of two new species of the Genus Thecla.

BY HENRY EDWARDS.

Thecla Putnami. n. sp. Hy. Edw.

♀. Upper side. Pale fawn color, shading into dark drab or stone color at the base and costal margin. Fringes entirely white. Secondaries with a series of four indistinct lunulate spots, black, edged beneath with white; anal

spot faintly tinged with golden yellow. Tails black, edged with white, and the apices also broadly white. Thorax and abdomen slate color. Antennæ dull slate, annulated with white.

Under side. Entirely grayish white. Primaries with black discal lunule and six submedian ovate black spots, each with a white ring. Near the posterior angle are four very faint black streaks, the under side of the primaries of this species bearing a close resemblance to that of many Lycænas, particularly that of Ly. Pheres. Bdv. Secondaries with black discal lunule and seven sub-median spots as in the primaries, except that the one nearest to the abdominal margin is lunulate. The marginal markings peculiar to the genus are very faintly produced; the anal spot is a blackish, cloud-edged above with orange; the second and third are blackish, with a few blue scales intermingled, visible only with a lens; the fourth black, surmounted by pale orange, and the remainder black lunules, becoming faint as they pass the median nerve.

Exp. of wings, 1.25 inch.

1 ♀ (Coll. Hy. Edw.) Mt. Nebo, Utah, July, 1875. Taken by my friend, Mr. J. D. Putnam, of Davenport, Iowa, to whom I have great pleasure in dedicating the species. I should have hesitated to describe this insect from a single specimen, but its very decided character leaves me no room to doubt that it is a new species. In this opinion I am confirmed by Mr. S. H. Scudder, to whom I submitted this and the following species, and who has included both in his "Synonymic List of American Rurales, 1876." A second specimen of *T. Putnami*, which in its general character most resembles *T. Dryope*, Edw., was taken in Colorado, in July of the present year, by Baron von Osten Sacken.

Thecla Adenostomatis. n. sp. Hy. Edw.

♂. Dull slate brown on the entire upper surface, with a slight golden reflection when viewed obliquely. Fringes concolorous. Antinnæ black, with white annulations; club, with its extreme tip orange above, entirely orange beneath. Eyes surrounded at their base by white hairs. Thorax and abdomen concolorous. Secondaries with anal angle slightly produced posteriorly, with a black streak at the base of the fringe, and above a very few blue scales. Tails short, black, with extreme tip white.

Under side of primaries slate drab, with very faint greenish tinge. Discal spot obsolete; a waved submedian unbroken line, white, edged anteriorly with dark slate; and six very faint submarginal patches of black. Secondaries, dark slate color at the base, from which along the abdominal margin are numerous white scales, giving a mottled appearance. Submedian band white, edged above with black, especially about the middle. Anal spot mottled with black and white; other markings a series of five or six lunules, black, edged above with whitish. All of these spots, when viewed with a lens, have a very faint trace of fulvous.

Exp. of wings, 1.15 inch.

♀. Similar to the ♂, except that the fringes are more decidedly white, the anal mark with a bluer tinge above, and the tail slightly longer than in the

other sex. The club of the antennæ is also wholly black, except the extreme tip, which is orange.

Exp. of wings, 1.25 inch.

25 4 ♂. Tehachepi Pass, Southern California. Taken by Mr. R. H. Stretch, July, 1875. Closely allied to *T. Tetra*, Behr, but differing from that species by the apparently utter absence of fulvous, which is only distinguishable by a powerful lens. It is also slightly a larger insect than *T. Tetra*, and the wings are all more angularly produced than in that species. It is, however, sufficiently near to be confounded with it, and probably may be found in other localities in California.

Remarks on the Crustacea of the West Coast of North America, with a Catalogue of the Species in the Museum of the California Academy of Sciences.

BY W. N. LOCKINGTON.

GRAPSOIDEA, OR OCYPODIDÆ.

OCYPODIDÆ.

Ocypoda Gaudichaudii? Edwds. & Luc. D'Orbigny's Voy. in Am. Merid. Crust., p. 26, pl. XI, fig. 4.

As I have not seen Edwards' description of this species, I subjoin a short description:

Carapax slightly wider across the centre than in front. Lateral angles of anterior margin very prominent, upper orbital border sinuate; front narrow, eyes large. Right cheliped much larger than the left in both sexes; arm trigonal, with its inferior surface somewhat concave, in consequence of both its margins being slightly raised and beset with spinous tubercles; the upper margin rounded, rugose with rows of small tubercles. Carpus short and stout, with a sharp spine on its anterior border at distal end, and rows of small tubercles above, becoming more prominent and somewhat spinose distally. Manus broad and thin, covered with tubercles exteriorly; a row of saw-like spines along the lower margin continued along the propodal finger, which is cristate, hooked at end, and with several teeth internally. Movable finger similar to fixed, spinose along its upper margin.

Ambulatory limbs flattened; merus with a sort of roll on its upper margin, crossed by tubercular rugæ. Carpi of second, third and fourth pairs setose at distal lower extremity; propodi of the same three pairs setose below; carpus and propodus of fifth pair without hairs; all the dactyli fringed in front with setæ. Third joint of outer maxillipeds narrower, and about half the length of the second joint.

First two segments of male abdomen very short; third and fourth longer, fifth still longer, sixth longest. Fifth segment narrowest; sixth convex on both sides; seventh a small truncate triangle. Fourth and fifth segments of

female abdomen widest; sixth a semi-ellipse, with the small seventh segment inserted in a concavity of the anterior margin.

	♂ M. M.	♀ M. M.
Greatest length of carapax	45	32
Greatest width of carapax	53	37.5
Length of right manus	48	28
Width of right manus	28	15

Several specimens from Magdalena Bay, West Coast Lower California; La Paz, Lower California; and Boca de las Piedras, Sinaloa, Gulf of California.

O. Gaudichaudii was found at Panama by Mr. Sternbergh (Stimpson, Notes on North Amer. Crust., p. 15); and also in the Gulf of Fonseca, Central America, by J. A. McNeil (S. T. Smith, Peabody Acad. Sci., 1869, p. 91).

No. 43. Male and female. Gulf of California. W. J. Fisher.

Genus Gelasimus.

Six species of this genus are included in the collection of Mr. W. J. Fisher. One only of these belongs to the section having a narrow front, with the bases of the ocular peduncles close together. This is the *G. princeps* of S. T. Smith.

Another species, having the fourth, fifth and sixth abdominal segments united, is certainly the *G. gibbosus* of the same author. Another I believe to be the *G. brevifrons* of Stimpson.

None of the remaining kinds answer to Stimpson's and Smith's description of *G. panamensis*, so that unless two of them are referable to the Chilian species, *G. macrodactylus* and *G. stenodactylus*, it is fair to suppose they are new species. I have described two of them as new, and the remaining one, with some misgiving, I provisionally refer to *G. stenodactylus*.

Gelasimus princeps. S. T. Smith. Trans. Conn. Acad., 11, 120, plate 11, fig. 10; pl. 111, f. 3-3c.

This species is found in holes under rocks at low tide. The female, as noticed by S. T. Smith, differs considerably from the male, having the carapax less narrowed behind, with granules thickly scattered over the dorsal regions.

Two large specimens measure:

	♂ *Inch.*	♀ *Inch.*
Extreme width of carapax	1.65	1.37
Extreme length of carapax	1.03	.35
Length of large hand	3.00	
Width of large hand	0.95	

Localities—Magdalena and San Bartolomé Bays, West Coast Lower California. W. J. Fisher. Corinto, Nicaragua. J. A. McNeil.

No. 51. Male and female. Magdalena Bay, in spirits. Fisher and Lockington.

G. heteropthalmus. S. T. Smith, *loc. cit.*, 116, pl. 11, f. 6; pl. 111, f. 1–16. Gulf of Fonseca, West Coast Central America.

G. heteropleurus. S. I. Smith, *loc. cit.*, p. 118, pl. 11, f. 7; pl. 111, f. 2–26. Gulf of Fonseca, W. C. Cent. Amer.

G. armatus. S. T. Smith, *loc. cit.*, p. 123, pl. 11, f. 5; pl. 111, f. 4–4*d*. Gulf of Fonseca.

G. ornatus. S. T. Smith, *loc. cit.*, 125, pl. 11, f. 9–9*a*; pl. 111, f. 5–5*c*. W. C. Cent. Amer.

G. brevifrons. Stimpson. Ann. Lyc. Nat. Hist., New York, vol. vii., p. 229. S. T. Smith, *loc. cit.*, 131.

I have not seen Stimpson's description of this species, but from Smith's comparison of its carapax with that of *G. minax*, I conclude that several specimens collected by Mr. Fisher on the West Coast of Lower California, belong to this species. The meros of the larger cheliped is stout, triquetral, and marked on its exterior surface with transverse setose striæ; the carpus has a rounded tooth at its inferior distal end, and the manus is large and heavy, twice as large as the width of the carapax, the palmar portion rounded and smooth, but minutely granular on the outside, and on the inside beset with small tubercles on its more elevated portions. The depression for the carpus is short but very deep, the thin upper edge of manus curving inwards over it. The propodal finger is slightly deflected downwards, and the dactylus curved from the base, the curve increasing towards the tip. The tubercles of the inner edges ot the fingers are very indistinct, except one near the centre of the propodal finger, and another close to the tip, which thus appears bifid.

In the smaller cheliped the tips of the fingers are obtuse and rounded, and the outer edges raised, so that they are imperfectly spoon-shaped. The dactylus and propodal finger are almost parallel and near each other, but touch only at the tip, where they have a few setæ.

The meral segments of the ambulatory legs are plicate, like those of the chelipeds.

Following are the dimensions of two large specimens:

	♂ M. M.	♀ M. M.
Length of carapax	17	13
Width of carapax	23	19
Length of larger hand	45	

The fourth, fifth, and sixth segments of the abdomen in the male are not united.

The carapax in this species is considerably narrowed posteriorly, is much less convex than usual in the genus, and of an olive color. The chelipeds of the female closely resemble the smaller cheliped of the male.

No. 85. Male and female. Magdalena Bay, in spirits. Fisher and Lockington.

Gelasimus stenodactylus? Edwds. & Lucas, Voy. dans L'Amer. Mer. Crust., 26 pl. 11, f. 2. M. Edwds. Ann. des Sci. Nat., 3d serie. Zoöl., tome xviii., p. 149. S. T. Smith, *loc. cit.*, 139.

I have not seen the description of this species by Edwds. and Lucas, and therefore question its identity with a single male specimen of a *Gelasimus* with very short fingers that was brought from the West Coast of Lower California by Mr. Fisher.

The fingers of the larger cheliped are very short, the dactylus does not attain the length of the inferior margin of the palm, and the propodal finger is much shorter.

The manus of the smaller cheliped resembles that of *G. gibbosus*. The carapax is highly convex, the anterior lateral angles almost in a line with the front, so that the orbital border is but slightly sinuous; the inferior orbital border dentate, and the lateral margins converging.

	M. M.
Length of carapax	7
Breadth of carapax	13
Length of larger hand	14

Gelasimus rectilatus, nov. sp.?

Among the *Gelasimi* collected by Mr. Fisher on the West Coast of Lower California are two specimens which I cannot refer to either of the broad-fronted species from this coast, described by S. I. Smith and Stimpson, viz: *G. gibbosus*, *G. panamensis* and *G. brevifrons*. As I have not seen the descriptions of *G. macrodactylus* and *G. stenodactylus*, it may possibly be one of these, though neither name seems applicable.

I append a short description:

Front narrower than usual in the broad-fronted section of this genus, not much more than half the width of the buccal frame; carapax tapering posteriorly, the sides forming an almost straight line from the antero-lateral angles to the straight posterior margin; antero-lateral angles much posterior to the line of the front, acute and with considerable lateral projection. Upper orbital border highly sinuous entire, lower orbital border toothed at its outer angle. Outer maxillipeds greatly gibbous, the buccal area separated from the jugal by a distinct depression. Larger cheliped smooth (microscopically granulated), except on inner surface of manus, where there is a line of small tubercles on the inner edge of the propodal finger, and a second on the ridge proceeding upwards from the lower edge of that finger. Fingers tubercular on their inner edges, the largest tubercles that in the centre of the length of each, and that near the tip of propodal finger. Fingers of smaller cheliped parallel, equal, imperfectly spoon-shaped.

Hands of female similar to the smaller cheliped of male. Ambulatory feet

entirely smooth, with a few hairs. Abdomen of male with all the joints distinct, gradually narrowing from the base.

	♂ M. M.	♀ M. M.
Length of carapax	9	8.5
Width of carapax	14	13
Length of larger hand	19	

The larger hand greatly resembles that of the species I have referred to *G. brevifrons*, but the fingers are proportionally shorter, a character which may, however, be due to immaturity. The great differences between this form and *G. brevifrons* are the entire want of the meral plications, and the form of the lateral margins of the carapax, which in the latter continue nearly perpendicular to the front for some distance before they commence to converge.

A single pair is all I have seen of this form. The great convexity of the carapax, and the absence of any coarse granules on the front and anterior part of the branchial regions, distinguish it from *G. panamensis*.

Gelasimus crenulatus. nov. sp.

Carapax highly convex, transverse, antero-lateral angles acute and prominent, slightly posterior to the front; superior orbital margin sinuous, inferior crenulated, the teeth equal in size and with a straight upper edge.

Dorsal surface smooth and shining; median and lateral gastric regions clearly marked off; cardiac distinct; branchial regions prominent, tumid, each divided in two by an indistinct sulcus, parallel with the lateral margins of the carapax.

A broad ridge on the inner edge of the fourth joint of outer maxillipeds, continued downwards along the greater portion of the inner edge of the third joint. Merus of greater cheliped stout, triquetral, marked with numerous short, transverse, not prominent rugæ. Carpus and manus smooth and unarmed, except a few small tubercles on the raised line anterior to the depression for the carpus on the inside of the manus. Propodal finger long and slender, pointed at tip, and with a tubercle in the centre of its length. Dactylus longer than propodal finger, curved, the tip of the curve considerably overpassing that of the latter. Merus of smaller hand slender, triquetral, smooth, carpus smooth, about equal in length to the palm of the manus; fingers equal, parallel, near together, touching at tips, which are pointed.

Hands of female like those of smaller male cheliped. Ambulatory feet smooth and shining, with a few long setæ on the propodi, and more numerous and shorter setæ on the dactyli.

The hand of this species is similar to that of *G. brevifrons*; the gibbous carapax, with its areolations, resembles closely *G. gibbosus*, but the third, fourth and fifth segments of the abdomen are free, instead of anchylosed, as in that species; and the margins of the carapax again resemble those of the species I have referred to *G. brevifrons*, but the convexity of the surface, with the tumid branchial regions, give it a very different appearance.

Unless this is the *G. macrodactylus* of M. Edwards, found on the coast of Chili, it is certainly a new species.

No. 49. Todos Santos Bay, near San Diego, dried. Hy. Hemphill.
No. 50. " " " " " in spirits. Hy. Hemphill.

Gelasimus gibbosus. S. I. Smith. Trans. Conn. Acad., March, 1870, 140; plate 11, f. 11; pl. iv., f. 8.

Numerous specimens from the West Coast of Lower California, principally from San Bartolomé Bay, agree with Smith's description and figure of this species in every particular, except in having the front more suddenly curved forwards. The sub-hepatic regions are thickly setose.

The fingers of the smaller cheliped are equal in length, and twice as long as the broad, stout, and short palmar portion of the manus; they are widely separated at their base, gape throughout their length, and are curved to meet each other at their extremities, which are of a yellowish brown tint. There are a few scattered hairs on the fingers. In the female both chelipeds are exactly like the smaller cheliped of the male.

The depression between the buccal and sub-hepatic (jugal) areas is very distinct; the teeth of the inferior margin of the orbit increase in size and slenderness on the outer portion; and the fourth, fifth and sixth abdominal segments are anchylosed. The prevailing tint of the carapax and limbs (in spirits) is blue, of varying intensity, shading in parts into greenish and into white on the fingers of the chelipeds. Many very small specimens have the fingers of the larger cheliped but little developed, not exceeding the palm in length, and closely approximated to each other.

At first I thought these to be a distinct variety, but now believe them to be the young of the same species, as they agree in every other particular, and some show evidences of a change in the relative proportions of the palm and dactyli as growth progresses.

No. 86. Male and female, in spirits. Bartolomé Bay. Fisher and Lockington.

GECARCINIDÆ.

Cardiosoma crassum.? S. I. Smith, *loc. cit.*, 144; pl. v., f. 5. Gulf of Fonseca, W. C. Cent. Amer. La Paz, Lower California.

A single fine male specimen from the latter locality agrees in most particulars with the figure and description referred to, but the carina of the lateral margin is much less distinct and high; and the larger hand differs in form.

As the specimen exceeds in size any of those measured by Mr. Smith, I think it possible that the differences referred to may be owing to the greater age of the individual; but as it may possibly prove to be a different species, I append a description of the chelipeds.

Merus and carpus as in *C. crassum*; larger hand short and broad, the depth exceeding the length of the superior margin. Propodal finger slender and straight, slightly spoon-shaped at extremity, with a large tooth near the

centre of its length, and several smaller teeth. Distal end of manus forming an angle of about 80° with the superior margin, and of about 60° with the propodal finger, which does not increase greatly in width towards its base. Dactylus slender with a large tooth nearer the base than the tip, which is inflated and spoon-shaped. Inner surface of the hand, towards the margins, armed with scattered tubercles of small size. Upper portion of manus curving inwards posteriorly, the carpus fitting, when the hand is bent, into the hollow between the upper incurved carina and lower thick portion of the manus. The smaller hand is similar to the larger. The stoutness of body of this crustacean is such that the sides of the branchial and hepatic regions are visible from above, and protrude laterally beyond the antero-lateral carina. The male appendages agree with those of *C. crassum.*

	M. M.
Greatest length of carapax, measured along its convexity....	100
Greatest width of carapax..................................	101
Length of larger hand to end of propodal finger..................	127
Length of larger hand from carpus to base of dactylus............	40
Greatest width of larger hand....................................	58
Width of carapax between antero-lateral carinæ in front...........	93

If this should prove, on examination of more specimens, to be a new species, I propose to name it *Cardiosoma latimanus.*

Gecarcinus quadratus. De Saussure. Revue et Mag. de Zoöl., v., 360; pl. xii., f. 2.

The work above referred to is not accessible to me In Mr. S. I. Smith's Notes on American Crustacea, Trans. Conn. Acad., vol. ii., *Cardiosoma quadratum*, Saussure, is referred to. Are they identical ?

The male appendages of *C. quadratum* figured in the plate iv. of the notes cited above differ from those of the *Cardiosoma* described under *C. crassum.*

Mazatlan.

BOSCIADÆ.

Potamocarcinus armatus. M. Edwards. Archiv. du Mus., vii., 174; pl. xiii. Obtained in the North Pacific Exploring Expedition in Lake Nicaragua. Stimpson. Prod. des Animal, evert, p. 46.

GRAPSIDÆ.

15. *Grapsus strigosus.* Latreille. Stimpson, Crust. & Echi., P. S. N. A., says: "Specimens in the Brit. Mus. from Lower California are referred to this species by White." White, Brit. Mus. Cat. Crust., p. 40.

Numerous specimens of a *Grapsus* from Lower California agree in every respect with the remarks upon this species in Dana's Crust. U. S. Ex. Exp., vol. 1, p. 338 ; having the merus of the right posterior legs three-toothed at its distal end, instead of entire, as in *G. pictus.*

No. 52. Mazatlan, dried. Henry Edwards.

No. 53. Locality unknown, dried. Donor unknown.

16. *Grapsus pictus.* De Saussure; Revue et Mag. de Zool., V., 362; Stimpson, Crust. & Echi., P. S. N. A., 26.

Stimpson doubts the identity of De Saussure's *G. pictus* with that of Latreille. I have as yet, among abundant specimens of crustacea from the east and west coast of Lower California, received but one species of *Grapsus*, and this does not agree, either in coloration or in the merus of the posterior legs, with the *G. pictus* described by Dana, Crust. U. S. Ex. Exp., 1, 337.

16. *Pseudograpsus,* } *Oregonensis.* Dana, U. S. Ex, Exp., Crust., 1, 334, pl. *Heterograpsus,* } XX, f. 6; Milne Edwards, Melanges Carcinologiques, 157; Stimpson, Proc. Cal. Sci., 1, 38.

No. 54. Three males, dried, S. F. Bay. Lockington.
No. 55. Several specimens, S. F. Bay. *Ibid.*

17. *Pseudograpsus,* } *Nudus.* Dana, U. S. Ex. Exp., Crust., 1, 335, pl. XX, *Heterograpsus,* } fig. 7; Milne Edwards, *loc. cit.*, p. 159; Stimpson. *loc. cit.*, 1, 38.

No. 56. Several specimens, S. F. Bay. Lockington.
No. 57. Several specimens, Black Point, S. F. Bay. Lockington.

18. *Goniograpsus pulcher.* nov. sp.

Carapax with numerous transverse lines, not extending to the central regions. Sulcus between gastric and cardiac regions, very distinct. One antero-lateral tooth behind the post-orbital. Sides convergent posteriorly. Perpendicular portion of front about four times as long as high. Outer antennæ exsert. Outer maxillipeds widely separated, narrow. Chelipeds subequal, merus triquetal, with the upper margin rounded, lower anterior ditto, produced into a wing-like keel, armed with about nine teeth on its edge; posterior margin toothed. Two or three teeth on the anterior edge of the ischium. Carpus with three teeth on its upper anterior angle. Manus broad and thin, smooth exteriorly, tubercular interiorly. Dactylus tubercular above. Upper surfaces of the merus crossed by transverse raised lines similar to those of the carapax. Carpus crossed, also, by rugæ, which show a tendency to split up into tubercles. Tubercles of manus arranged in longitudinal rows along its upper margin. Ambulatory legs, with the distal end of merus three-toothed, the upper tooth sharp, the two others long and rounded lobes; terminal joints with scattered hairs; dactyli spinose. Abdomen of the male with the two first joints very short, the third joint widest, and with strongly convex sides; remaining joints regularly diminishing in width, with a slight convexity. Color citrine, with a variable reticulation of dark brown, the ground becoming yellowish upon the legs. Chelipeds bright red.

Several specimens of both sexes from Magdalena Bay, west coast, Lower California.

The measurements of two average-sized specimens are as follows:

	♂	♀
Greatest length of carapax	40	30
Greatest width of ditto	43	34

The branchial regions are much elevated in old specimens.

I have preferred to employ Dana's name of *Goniograpsus* in preference to Randall's *Pachygrapsus*, as the generic characters given by the former author are the more precise and definite.

This species appears to be very near to the *Goniopsis cruentatus* of De Haan, but that species has the hand, carpus, and dactylus small spinulous above.

No. 58. Magdalena Bay, in spirits. W. J. Fisher.

19. *Pachygrapsus* (*Goiograpsus*) *crassipes*. Randall, Jour. Acad. Nat. Sci., Phil., VIII, 137; Stimpson, Crust. & Echi., P. S. N. A., 27.

No. 59. Several specimens, S. F. Bay. W. N. Lockington.

20. *Goniograpsus* (*Pachygrapsus*) *transversus*. Gibbes, Amer. Asso. Adv. Sci., 1850, p. 181; Stimpson, Ann. Lyc. Nat. Hist., N. Y., vol. VII, p. 64; S. I. Smith, Rep. Peabody Acad. Sci., 1869, p. 91.

The last named writer mentions specimens from Havana, the Gulf of Fonseca, and other points of the Pacific coast.

I have not seen either the species or a description of it, and therefore cannot be certain that the species just described may not be identical with it; but if so, the name *transversus* is very inapplicable.

21. *Glyptograpsus impressus*. S. I. Smith, Trans. Conn. Acad., vol. II, p. 154. Acajutla, west coast, Central America.

32. *Goniopsis cruentatus*. De Haven; S. I. Smith, Rep. Peabody Acad. Sci., 1869, 91.

23. *Sesarma sulcata*. S. I. Smith, Trans. Conn. Acad., *loc. cit.* p. 156.
Corinto, W. coast Nicaragua.

24. *Sesarma occidentalis*. S. I. Smith, *loc. cit.* p. 158.
Acajutla, W. coast Central America.

25. *Sesarma augusta*. S. I. Smith, *loc. cit.* p. 159.
Pearl Islands, Bay of Panama.

26. *Aratus Pisoni?* M. Edwds, Ann. Sci. Nat. 3d ser., 1853, tome XX, p. 187. Hist. Nat. des Crust. II, p. 76, pl. 19, f. 45.

"A specimen from Corinto, Nicaragua, appears to belong to this species, but it has not been carefully compared with east coast specimens." S. I. Smith, Rep. Peabody Acad. Sci., 1869, p. 92.

GONOPLACIDÆ.

27. *Prionoplax ciliatus*. S. I. Smith.
Panama.

Prionoplax spinicarpus. M. Edwds., Ann. des Sci. Nat., 3d series, XVIII, 161. *Ibid*. Archives du Mus. d'Hist. Nat., VII, 167, Pl. VI, f. 3. Stimpson, Notes on N. Amer. Crust., 13.

28. *Euryplax politus*. S. I. Smith.
Panama.

29. *Glyptoplax pugnax*. S. I. Smith.
Panama.

30. *Eucrate Californiensis*. Lockington, Proc. Cal. Acad. Sci., Feb. 7, 1876.
No. 61. San Diego, (Hy. Hemphill), dried.

This species is certainly neither of the preceding, but appears to closely resemble Stimpson's *Speocarcinus Carolinensis*.

PINNOTHERIDÆ.

31. *Pinnotheres faba*. Dana, U. S. Ex. Exp., 1, 381, pl. 24, fig. 4. *Pinnixa faba*. Stimpson, Crust. and Echi., P. S. N. A., p. 30.
Found in the large Lutraria of the Oregon coast.

32. *Pinnotheres margarita*. S. I. Smith, Trans. Com. Acad., Vol. II, p. 166, Verrill, Amer. Nat., III, 245.

Two females of this species was brought by Mr. W. J. Fisher from Mulege Bay, Gulf of California.

"Everywhere covered, except the dactylus of the right ambulatory leg of of the second pair in the female, and tips of the others in both sexes with a very short and close, clay-colored pubescence, much like a uniform coating of mud."

Found in the pearl oyster, *Margaritophora fimbriata*.

A new species of *Pontonia* (*P. margarita*, Lockington,) is mentioned by Mr. Fisher as having been taken from *Margaritana margaritifera*, at Port Escondido, Gulf of California, but as Mr. Fisher's collections were almost exclusively marine, it is not unlikely that the above mentioned mollusk was the one he meant to indicate.

33. *Pinnotheres lithodomi*. S. I. Smith, Trans. Conn. Acad., *loc. cit.*
From *Lithodomus aristatus*, Pearl Islands, Panama.

34. *Pinnotheres angelica*. nov. sp.

Carapax smooth and shining, soft and slippery, without sutures, (when undried) somewhat transverse. External maxillipeds widely divaricate posteriorly; the third joint shaped like a boomerang, the external convex margin more curved than the concave internal margin; distal extremity rounded and ciliate on its internal edge, terminal joints ciliate. Chelipeds smooth, cylindrical, save that the manus is somewhat compressed distally; dactylus short, about half as long as the posterior part of the propodus, and equal in length to the propodal finger; both fingers hooked at the end, without teeth on their

aternal borders. Ambulatory legs slender, cylindrical, smooth, dactylus of first pair short, that of second pair about as long as the propodus; those of third and fourth pairs equal in size, rather larger than that of first pair and about half as long as the propodi; that of fourth pair ciliate on its internal margin. Abdomen very large, wider than the carapax and covering the maxillipeds and even the eyes, when folded.

Several specimens, all females, were collected at Angeles Bay, Gulf of California, September, 1876, "in oysters."

	♂ M. M.	♀ M. M.
Length of carapax	11.5	9
Width of carapax	15	12
Breadth of abdomen	16.5	13.5

Many of the specimens are loaded with ova.

35. *Fabia subquadrata.* Dana, U. S. Ex. Exp., I, 882, pl. 24, fig 5. Stimpson, Crust. & Echi. P. S. N. A., 30.

Puget Sound. Farallone Islands.

No. 83. In spirits, from mantle of *Pachydesma crassitelloides*. San Diego, (Hy. Hemphill.)

36. *Dissodactylus nitidus.* S. I. Smith, Trans. Conn. Acad. Sci., 1869, 173.

Panama. Gulf of California. (Fisher.)

Two females from the latter locality have the peculiar bifurcate dactyli, from which Mr. S. I. Smith has named the genus *Dissodactylus*, and probably belong to *D. nitidus*, of which that author describes the male. The carapax is firm, somewhat wider at the lateral angles than posteriorly; convex in front and at the margins, without any upturned border along the antero-lateral margin, but with a short fissure extending obliquely inwards immediately anterior to the lateral angle. The posterior margin has an upturned border. There is no pubescent tuft on the inferior edge of the propodal finger. The ambulatory legs are as in the male. The abdomen resembles that of *Pinnotheres*, the terminal article reaching and partly covering the buccal frame. The prevailing color is dark purplish brown, with spots of white upon the carapax, and a ring of white at each joint of the limbs. The dactyli are white.

37. *Pinnixa? nitida.* nov. sp.

Male. Carapax exceedingly transverse, smooth, shining, color in spirits, bright orange; all the limbs smooth and shining, without pubescence, of a straw yellow color. Maxillipeds very small and triangular, closely fitted to the buccal area, smooth and shining, as is also the sternum. Abdomen narnow at base, second segment rapidly widening, third widest, fourth, fifth and sixth tapering rapidly, seventh almost as long as wide, triangular, with the apex rounded. The abdomen does not cover more than one-half the sternal area. Chelipeds shorter than either second or third pair, the manus broad, with two setose ridges on its anterior surface, fingers short, hooked, toothless, movable finger oblique. Three last joints of ambulatory limbs flattened, carpus broad at distal extremity, scarcely longer than wide; propodus nearly twice as long as wide; dactylus slender, cylindrical, white, ending in a sharp yellow claw. Margins of last three joints setose, second pair (first ambulatory pair)

longer than the third, which are themselves longer than the chelipeds, fourth pair shorter, fifth very short.

	M. M.
Width of carapax	11
Length of carapax	5

Female. Carapax broadly transverse, smooth, shining, margins curved, angles rounded. Outer maxillipeds much larger than in the male just described, parallel, tomentose. Chelipeds shorter than fourth pair, hand short and rounded, wider than thick, tomentose, propodal finger short, hooked, dactylus oblique, hooked, toothless. Merus, carpus and propodus of all the ambulatory limbs greatly compressed; propodus as long as wide; carpus nearly twice as long as wide; dactylus short, cylindrical, ending in a sharp claw. Abdomen broad, covering the whole sternum, and fringed with long hairs round its margin. The pubescence of the chelipeds is continued along the fingers nearly to their tips, and is found also on the external portions of the carpus and flattened joints of the ambulatory limbs, as well as on the hepatic region. The color, where free from pubescence, is a brownish yellow (in spirits).

	M. M.
Length of carapax	7.5
Width of carapax	14

A single specimen of each the two crustaceans just described was collected on the same day at the same locality, namely, Angeles Bay, Gulf of California, and the two were placed by the collector (Mr. W. J. Fisher) in the same phial. Had it not been for this, I should certainly have never linked together two specimens so distinct in the relative proportions of the limbs themselves, as well as of the joints of those limbs; one covered in many places with an abundant pubescence, the other smooth and shining above and below. The proportions of the ambulatory limbs in the female agree with the genus *Pinnixa*, but in the male the increase of size is transferred to the second pair. Should these crustacea prove to be distinct the female should be *Pinnixa tomentosa*, while the male must be placed in some other genus.

I have no means of ascertaining upon what species of invertebrate animal these crustacea resided as commensals.

38. *Pinnixa longipes*. (*Tubicola longipes*. Lockington, Proc. Cal. Acad. Sci., April 17, 1876.)

This species should properly be placed in the genus *Pinnixa*. It possesses the characters of transverse carapax, and elongated fourth pair, in an extraordinary degree.

No. 60. Tomales Bay. (Lockington.) in spirits.

When I wrote the description of this species, I was not aware that any species of Pinnothere had previously been found quartered upon a worm, but I have since found that Stimpson (Notes on N. Amer. Crust., 21, 23) mentions two species, both belonging to this genus, that live in similar localities.

These species are, *P. cylindrica*, which inhabits the tube of the *Chætopterus*, of South Carolina, and *P. lævigata*, which lives with the lobworm, *Arenicula cristata*, in its hole, not lined by any tube, in the sand.

A New and Expeditious Method of Placing the Transit.

BY T. J. LOWRY.

The most approved methods of finding latitude and time are those with the telescope in the plane of the meridian; and hence this plane is the first object of the practical astronomer's search in the observatory. The methods now understood by the astronomer of getting his instruments in the meridian are all trial methods, each of them finding a meridian only by a series of continued approximations, consuming time and effort proportionate to the skill of the observer, the accuracy of the knowledge of his time and latitude, and the rapidity of the successive appearance of favorable stars on his meridian.

The method now proposed requires but little practice and less skill to place an instrument in the meridian by one observation only, without any knowledge of the latitude or time except to the nearest five or ten minutes.

The essential idea of this method is to observe two stars of the same, or differing twelve hours in, right ascension, but of different north polar distances, at the instant of their simultaneous passage of our meridian. Now, since our zenith is a point in the plane of our meridian, and since the plane of the declination circle of any two stars of exactly the same, or twelve hours different, right ascensions, is by the diurnal revolution of the earth made to coincide successively from east to west with every terrestrial meridian, it is obvious that we have but to (select and) observe two such stars at the instant that they and our zenith are in the same vertical plane and clamp, and we have our instrument fixed in the plane of its meridian.

To accomplish this simultaneous observation of two such stars with a transit, zenith telescope or theodolite, we attach to the tube of the telescope directly in front of its object-glass a plane mirror, half silvered to admit of direct and reflected vision, with its axis of rotation horizontal, parallel to its plane of reflection and perpendicular to the line of collimation of the telescope. Attached to this axis is a small vertical finding circle for setting this mirror at any desired angle with the collimation line. In form this mirror may be either an elliptical ring with only the quicksilver removed (or the glass also cut away) from its center, or that of the ordinary sextant horizon glass with its silvered half uppermost. This mirror should have its front and back faces perfectly parallel, and be from one-fourth to one-third of an inch thick, so that by having on its front face two fine lines cut at right angles to each other, we can, by making the reflected image of each of these lines coincide with its direct image, adjust its plane of reflection perpendicular to the telescope's collimation line, and thus also find the index error of its finding circle. In this adjustment use the collimating eye-piece.

This method of getting one star of a pair into the telescope field by a single reflection, and the other by direct vision, will work admirably when the stars differ considerably in north polar distances; but when this difference is small and we point on one of the stars direct, it becomes imperative to subject the

other to a double reflection, by using an additional mirror, as in the sextant, or employing the principle embodied in the Steinheil heliotrope. We may, however, avoid this double reflection of either of the stars of such a pair by pointing the telescope on the artificial horizon image of one of them, and thus get the other into the telescopic field by a single reflection.

When the stars of a pair have the same right ascension, we will have them enter the field of the telescope on the same side and move across in the same direction, the faster mover, as it were, chasing the slower, and catching up with it at the instant of their simultaneous passage of the meridian. But with a pair of stars differing twelve hours in right ascension, *i. e.*, one of them culminating *sub polo*, they will enter the telescope field on opposite sides, move across and meet exactly on the meridian. It is hence obvious that a pair whose stars differ 12 hours in right ascension offers the advantageous feature of the sum of their motions to aid the observer in deciding upon the exact instant of their coincidence in the telescope field, whereas with a pair having the same right ascension he has only the difference of its stars' motions to assist him in gxing upon this instant.

But when the catalogues do not offer star pairs culminating at desirable times, of suitable magnitudes and declinations, and of the same or exactly 12 hours different right ascensions, and thus permitting the application of the method in its greatest perfection, we may yet find our meridian most accurately by selecting and observing suitable pairs, the right ascension of whose stars differ but a few minutes from being identical, or exactly 12 hours different. Now the zenith of a position is a point common to all its vertical planes, and since the plane passing through the earth's center and any two stars differing more in declination than in right ascension, is, by the diurnal revolution of the earth, made to coincide successively with one of the vertical planes of every point on the earth's surface, we hence have but to observe two such stars at the instant they and our zenith are in the same vertical plane, and clamp, and we have our instrument in a vertical plane whose deviation in azimuth is determined by, and easily derived from, the north polar distances of the two stars, the difference of their right ascensions, and the co-altitude of one of the stars (or our co-latitude), we can observe the co-altitude of one of the stars at the instant of their coincidence in the telescope field. Having selected a list of such star pairs, we can readily compute a table from which an observer at any known latitude can pick out the azimuthal deviation of his instrument in degrees, minutes and seconds, at the instant two such stars coincide in his telescope field. Or, instead of using the co-latitude, which must then be known, we can use, in the preparation of such a table, the zenith distance of one of the stars; otherwise we may tabulate the hour angle in time (minutes and seconds) of the hinder of the two stars at the instant of their coincidence in the field of the telescope, either for the different altitudes of this star or for the different latitudes.

The method of observing such a pair with the aid of the last named table will be as follows: Having taken care in selecting to have one of the pair a star of such magnitude and position as to be readily identified by a stellar chart or allineation, we set the mirror in front of the object glass, at an angle

with the collimation line equal to one-half of the supplement of the algebraic difference of the north polar distances of the two stars, and bring the more readily identified one of them into the field of view, and follow it till its mate appears there, either meeting, chasing or fleeing from it. We then "pick the beat" of the watch or chronometer, and beginning to count the beats at the instant the stars coincide in the telescope field, follow the hinder star till the moment its "tabular hour angle" expires, and clamp, and our instrument is in the meridian.

A pair of fast-moving stars will give an accurate meridian, yet practically it will in general be found preferable to have one of the pair a star of slow motion, so that it can be readily bisected and followed until the instant its fast-moving mate strikes the middle wire, thus enabling the observer to clamp his instrument at exactly the right time without hesitation or doubt.

If the table gives the hour angle in time of the hinder star at the instant the two stars and our zenith are in the same vertical plane, then their relative right ascensions and positions with reference to the zenith must be as follows, viz: 1. If both stars are on the same side of the zenith then the star having the greater zenith distance must have the smaller right ascension, and this rule holds when one is a zenith star. 2. But if one star is south and the other north of the zenith then either may be in advance, but practically it is preferable that the slow mover "bring up the rear." 3. When a star south of or in the zenith is paired with a sub-polar, then the latter should not be quite twelve hours in advance of the former. 4. If a star north of the zenith has a sub-polar mate, then the upper culminating star should transit the meridian first, if it is the lower culminating star that we are following with the cross thread, and *vice versa*.

But if our table gives the azimuthal deviation, in degrees, minutes and seconds, of our instrument at the instant two such stars coincide in the field of its telescope (its plane of motion being, of course, vertical) then it is a matter of indifference which star precedes, since this angular deviation can be turned off either backward or forward on the horizontal limb of the instrument.

Within the latitudes of the United States the following varieties of pairs will offer, viz:

Class A. Pairs whose stars have the same, or differ but a few minutes, in right ascension. 1. Two circumpolar stars. 2. A circumpolar star and a time star, the latter being either in the zenith or south or north thereof. 3. Two time stars, either one north and one south of the zenith, or both north or both south thereof, or one star in and the other star either north or south of it.

Class B. Pairs, the stars of which differ exactly 12 hours in right ascension, or lack but a few minutes thereof. 1. Two circumpolar stars. 2. A circumpolar star and a time star either in or south or north of the zenith.

With respect to the relative motions of the stars of a pair most important to the observer in deciding upon the exact instant of their coincidence, class B is in general more favorable than class A. And the pair in class B which

furnishes the maximum amounts of azimuthal motions (in opposite directions), and hence most desirable, is a lower culminating circumpolar star and an equatorial star; while with a pair of circumpolars the sum of these motions is a minimum. And of those in class A, a close circumpolar star and an equatorial star gives the greatest difference of motions; while a pair of circumpolars gives the least. When the stars of a pair move in the same direction, and at not very greatly different speeds, they will doubtless be found to cling together in the telescope field a provokingly long time.

As to the frequency of their availability, the pairs of circumpolar stars stand pre-eminent; since they are on our meridian and its visible extension twice in every 24 hours, they are hence doubly more available than the other pairs which transit our meridian but once in that time.

As to the amount of computation required—an element only in those pairs whose stars are not exactly on the same declination circle or *its visible extension*—when a zenith star is paired with either a south or a north star (at upper or lower culmination), following within a few minutes, the computation is a minimum, for then the difference of the times of the stars transiting our meridian equals the difference of their right ascensions; and the zenith star obviously transits the meridian at the exact moment *it* and its mate are in the same vertical plane. And when its mate is a close circumpolar star their mean right ascensions will prove all-sufficient because *from the slowness* of its motion in azimuth the error of assuming the difference of their mean, equal to the difference of their apparent, right ascensions will in *general be* inappreciable. And it may often occur that the error of assuming this of two stars having nearly the same precession in right ascension will enter the resulting azimuth in so diminutive a form as to be quite *allowable*, except in a very close work.

If the stars chosen fall in a part of the celestial sphere *illuminated by the* sun as they transit our meridian, they will require to be of larger magnitudes than such star pairs as, being in the opposite part of the heavens, *cross our* meridian at night. Especial effort should be made to incorporate the double stars into pairs, from the facility and certainty with which they can be identified in the telescope field.

And again, if tables are available giving the exact right ascensions and declinations of Mars and Jupiter, they may be advantageously *paired with* suitable stars; and their continuous motion among the stars renders them more available, since they cross successively the declination circle *of every* star in the heavens. But the use of these planets will necessitate a more accurate knowledge of our time.

Experience has proven that, in reconnaissances, rapidity of execution in finding latitude, time and azimuth, is all-important and in many cases essential to success; and hence methods and instruments which yield a *maximum* amount of results in a minimum time are in especial demand. Under the contingency, often arising in reconnaissance and exploration, that the *latitude* is not known and the time only to the nearest five or ten minutes; and when limited in time and facilities, as the reconnoiterer or explorer *per necessitatem* generally is, then this method will be found most acceptable; for it is obvious that by bisecting one of the stars of a pair (of identical right ascension) with

the horizontal thread at the instant the two stars are on the middle vertical thread, and also at this moment noting the face time of the chronometer, that we have the meridian altitude of a star whose declination is known, and hence our latitude, and also the observed time of meridian transit of a star of known right ascension, and hence a chronometer correction, simultaneously with the observation that fixed our instrument in its meridian, the error of our chronometer, and our latitude, we can if desirable proceed at once to the observation of additional stars for a closer time and to test our latitude and azimuth.

A reflecting circle or sextant mounted on an alt-azimuth stand is *per se* (*i. e.* without an additional mirror) the instrument most convenient and ready for finding by this method the meridian, latitude and time for the reconnoiterer, explorer or land surveyor; and it may be found especially serviceable in hydrographic and geographical reconnaissances, whether in the course of an exhaustive survey, or only a flying reconnaissance of a coast or continent.

And from the readiness with which this method places "the transit" and "zenith telescope" in the meridian it will be found useful and may prove acceptable to even the most conservative practical astronomer.

Mr. Lowry finds that the B. A. catalogue offers an abundance of star pairs of suitable magnitudes, declinations and right ascensions. With the mean places of stars brought up to Jan. 0. 1877, between the siderial times 0h. 07m. and 0h. 57m. he finds 6 pair stars differing less than 3 seconds in right ascension, 4 pairs less than 7 seconds, 7 less than 16 seconds, and 5 less than 29 seconds.

A yet neater method of getting a meridonal plane is to select three stars so that stars A and B are of same declination and differ 10 or 15 minutes in right ascension, and star C differing several degrees from them in declination, but with a right ascension equal to one-half of the sum of those of stars A and B. Now observe the coincidence of stars A and C in telescope field and read horizontal circle, and then the coincidence of stars B and C in the field of view and read the horizontal circle, then set the vernier at the point midway between these horizontal circle readings and our telescope is in its meridian.

The President announced that the Council and Trustees had appointed the following Nominating Committee: Horace Davis, J. H. Smythe, S. B. Christy, Wm. Norris and P. B. Cornwall.

Dr. Wozencraft was introduced by Dr. A. B. Stout, and made some remarks on the feasibility of reclaiming the Colorado Desert of California.

Regular Meeting, December 18th, 1876.

President in the Chair.

Thirty-seven members present.

Donations to Museum: Large collection of plants from Joseph A. Clark, Mendocino County. From Dr. J. M. Hill, three specimens gold quartz, Calaveras County. From Henry Edwards, one specimen of jade from near Dunedin, New Zealand. From G. A. Treadwell, specimen of chromic iron, Forest Hill, Placer County, Cal. From A. J. Severance, specimen of porphyry, (core of diamond drill,) from 400 feet below the surface, Virginia, Nevada.

Tribulus from the Eastern Shore of the Gulf of California.

BY DR. A. KELLOGG.

Mr. Wm. J. Fisher collected the following very ornamental *Tribulus* from the eastern shore of the Gulf of California.

Tribulus Fisheri. K.

Stem annual, erect, branching from the base, the spreading stems again more or less branching at the top, somewhat nodose, striate, more or less hispid throughout, chiefly at the nodes, and 1½ feet high; leaves alternate, only the uppermost cauline and ramose, opposite, lower pinnæ largest, leaflets 6–8 or 9 pairs, oblong, subacute, submucronate, 4–6 or 7-lines long, oblique—one or more strong lateral nerves—hispid beneath, margins entire or subserrulate; stipules linear-subulate; peduncles thickened upwards, longer than the leaves, 1–3 inches long, axillary, or opposite the leaf; sepals 5–6, colored, narrowly lanceolate, acuminate, margins scarious, very bristly-hirsute on the back, less than half the length of the petals, or about 5-lines; flowers orange yellow, 2¼ inches diameter, petals five, obovate, obtuse, subcuneate, 13-lines long, 10–11 broad; style long, 3–4 times the length of the carpels and longer than the stamens, clavate, strongly 10-striate; carpels ten, 1-seeded, in a whirl around the base of the style, indehiscent, but readily deciduous at maturity from the elongated toroid style, obliquely triangular, laterally wedge-compressed, outer edge thickened, gibbous below base, and truncate, beak obsolete, pitted in two rows on the sides, crested on the back with five blunt, stout, murecoid tubercles, carpels scarcely more than a line high. Highly ornamental plant.

It is worthy of note that among Mr. Fisher's collection from Rattlesnake Island, harbor of San Diego, April, 1876, are also specimens of a variety of

Pectis papposa, Gray, which very much abounds in large dotted glands throughout, especially on the leaves (1–2 inches long, ½-line wide), mucronate, often slightly connate at base—opposite lower branches and similar portion of the stem purplish—slender peduncles enlarged near the base of the heads, sulcate corresponding to the 6–9 involucral scales which are dotted with 1–2 large glands on the back at the tips, margins involuted, but not scarious, infolding the ray akenes in their channels. These rigid, yellowish-green scales are rounded abruptly at the base and laterally attached; orange rays same in number, but longer, their akenes without pappus, or only a very minute united scaly crown; pappus of the disk of 20–25, tawny, rather long, unequal barbellate bristles similarly cohering.

An exceedingly beautiful and delicate pink-purplish morning-glory, brought by Mr. Wm. J. Fisher from Ajiabampo, of the Gulf of California, has very handsomely radiated leaves, adding a new glory to these very beautiful twiners. We, therefore, propose to name it

Ipomœa radiatifolia. K.

Stem slender, twining or creeping, 2–4 or more feet high, glabrous, somewhat petangular, fistulous; leaves alternate, or more rarely opposite, pedately 5–12-parted, lobes linear, filiform, mucronate, margins thickened and entire, lateral lobes subdivided into 2–4 outer lesser lobes (giving the leaves a delicate, airy, rounded, radiating outline), petioles slender, 1¼ inches long (or shorter than the longest middle, and distinct lobe), muricated (no stipules); peduncles 1-flowered, axillary, 2–3 inches long, articulated ½-inch or more below the calyx, bibracteolate at the insertion of the pedicel, bracteoles minute, subulate, scabrulose at the joint; calyx 5-sepaled, equal, naked, narrowly lanceolate-linear, acuminate, thin, 3-nerved, margins scarious, subentire; corolla purplish-pink, broadly funnel-form, 1–2 inches diameter, tube gradually enlarging to the throat of the widely expanded campanulate border; stamens and style included, unequal, filaments hirsute to the oblong saggitate anthers (scales none), style long, glabrous, stigma 2-lobed, semicircularly fan-shaped, often subdivided into minute lamellary lobules, minutely villous; Root and mature fruit unknown; embryo 2-celled, smooth.

Pacific Coast Lepidoptera, No. 22.—Notes on some Diurnal Lepidoptera, with descriptions of new varieties.

BY HENRY EDWARDS.

Mr. W. H. Edwards, of Coalburgh, West Virginia, has in view the speedy publication of a complete check list of North American butterflies, and it has been suggested by him that all facts connected with the group known to observers in different parts of the region comprised by the work, should at once be published, so as to bring together such information as may, if deemed worthy, be incorporated in the more important publication. With this view I have made the following notes on some doubtful or little-known species, at the same time calling attention to such strongly marked varieties of some of

our butterflies as seem to me worthy of special note. In these days of doubt as to the "origin of species," every trifling fact which can shed light on so important a field of inquiry becomes of striking value, and it appears to me necessary for all varieties which are apparently permanent to bear a distinguishing name, so that they may at once be recognized and hold their proper place in our nomenclature. The following remarks will be, therefore, taken at their true value, as I by no means claim that all of the forms described in this paper should rank as distinct species, though future observations may possibly elevate some of them to that position.

Parnassius Clodius. Menetries.

This species, like all of its genus, is liable to great variations, and there is little doubt that some of its extreme forms have been described under other names. Indeed, I am conscious of having unwittingly led Mr. W. H. Edwards into the error of believing that our forms represented *Clodius*, Menetr., and *Clarius*, Evers., and on my authority he has figured them as such in his "Butterflies of North America." Subsequent observations, however, led me to the conclusion that we had but one species, and the capture of some sixty or seventy specimens in Bear Valley in 1873, gave me a long series of intergrades, in which both of the forms above alluded to were certainly included, and with the knowledge that *Smintheus* and *Behrii* were but variations of one species, I could do no other than acknowledge the incorrectness of my former opinion. Dr. Boisduval appears also to have once been led into the same error, and afterward to have rectified it, as he leaves *Clarius* out of the list of species in his "Lepid. Calif., 1869." The clearness of the white ground, the size of the colored spots, and the presence or absence of the red basal patches of the under side, do not appear to constitute permanent characters, though at first sight they would seem to indicate distinct specific relations, while the size of the insect and the intensity of the colored patches seem to be modifications resulting probably from various altitudes, those of the less elevated regions being usually most pronounced in color. It should be remembered that *Clarius* was described by Eversman from specimens taken in the Altai Mountains, Siberia, and, on the high authority of Mr. H. W. Bates, our "Californian specimens do not resemble at all *Clarius* of the Altai," so that we have to blame Boisduval for introducing that species into our lists, instead of alluding to our extreme variations (as has been done in the case of *Behrii*) by a new name. That they are worthy of such distinction there can be no doubt, and I propose for perhaps the widest range of variety the following name, the specimens from which the description is taken being in my own collection. It must be borne in mind that this variety wanders considerably farther from the type than that figured by Mr. Edwards as *P. Clarius*, Evers.:

Parnassius Menetriesii. Hy. Edw. n. var. of *Clodius*. Menetr.

Imago ♂. Smaller than the typical forms of *Clodius*. Ground color of wings, sordid white; semi-transparent margin rather narrow, with the white lunules indistinct; the whole of the black marks of primaries are fainter than in *Clodius*, and there is no black spot in the submedian interspace. The sec-

ondaries have the abdominal margin comparatively more deeply edged with black, the line being distinctly bent inwardly toward the extremity of the cell; the colored spots are very small, almost obsolete, becoming simply pale pinkish or yellowish dots, surrounded by a narrow black ring. Under side vitreous, with a yellower tinge than above; all the marks fainter, except the colored spots of the secondaries, which are here, though small, distinct in color, and have white pupils. There is also a faint indication of a black bar on the anal angle, but no trace whatever of crimson basal patches. Head, thorax and abdomen beneath densely clothed with deep yellow hair, much darker and a more brilliant tint than in the typical form.

Exp. of wings, 2.25 inch.

♀. In nearly all respects this sex of the present variety resembles the ♂ of the type, and would at first sight be certainly so regarded. The transparent space of primaries is much smaller than usual; the bands are narrower and less defined, so that the white area of the wing is nearly as large as that of the male insects. The black patch in the submedian interspace is rather large, and the veins more sharply marked throughout. The secondaries have the colored spots small, but distinct in color, mostly pale crimson or orange, and surrounded by a black ring. The abdominal margin is only faintly black, and there is a trace of a black bar at the anal angle, which is, however, entirely without red. Under side similar to the upper in the black markings; the colored spots of secondaries are bright in color, and in some specimens there are two basal red patches, the anal bar more distinct than above, but without red. There is a seam of yellow hair along the abdominal margin, surmounted by yellow scales, a character which I do not find in my typical specimens of *Clodius*, and the yellow hair of the thorax and abdomen are almost golden in their tint.

Exp. of wings, 2.50 inch.

Bear Valley, Sierra Nevada (Hy. Edw.), Lake Tahoe (Hy. Edw.), Downieville, Cal. (Dr. Behr), Mt. Nebo, Utah (I. D. Putnam).

Parnassius Smintheus. Dby. Var. *Behrii.* Edw.

I have two specimens of this insect in my collection, one taken by Mr. J. Hutchings, of Yosemite, on the top of Mt. Dana, Cal., at an elevation of 10,000 feet, and the other by Mr. I. D. Putnam, in Summit Cañon, Utah. It is somewhat singular that the typical form of *Smintheus* never occurs in California, while the variety should be found here. Both of my specimens have the spots orange, and the double row of marginal lunules on the secondaries so characteristic of this strongly marked form.

Pieris venosa. Scud.

Perhaps there is no group so puzzling to an entomologist as that of the genus *Pieris*, to which this species and its allies belong, and the number of names which we find in our catalogues are the natural outgrowth of the widely different variations which we find in collections. Our Pacific Coast species rather tend to increase the confusion than otherwise, and in the separate opinions which exist as to their specific rank the complication becomes more and more intri-

cate and unsatisfactory. In Lepid. *Heteroc. et Rhopt.*, No. 8, Mr. H. Strecker has advanced the idea that *P. venosa* and *P. castoria*, Reakt., are one and the same thing, and that they are simply the American forms of the European *P. Napi*, and I can, after an examination of many scores of specimens, but simply endorse his views. That *venosa* and *pallida*, Scud., = *castoria*, Reakt., are at times represented by widely differing varieties no one can deny, and if we take the extreme forms we should naturally regard them as distinct species; but intergrades may always be found, and among these intergrades we find what Scudder designated as *pallida*, which more nearly approaches Reakirt's type of *castoria* than it does that of Scudder's *venosa*. But the insects are not, as has been suggested, spring and summer generations, as they are both found together, appearing in early spring (sometimes in February), and continue on the wing until the end of April or the beginning of May, when they begin to die out. But admitting *P. venosa* and *P. pallida* to be forms of the same species, what becomes of *P. oleracea?* Among my specimens captured during the present year, as well as others taken in Colorado, Oregon, Vancouver Island, and Northern California, are some which continue the series of intergrades until they are merged into the exact counterparts of the Atlantic species of *P. oleracea*, and cannot be in any way distinguished from the well known species of the Eastern States. Is *P. oleracea*, then, but another form of a trimorphic or polymorphic species? Then, again, many of the individuals of *P. pallida* approach very closely (so closely as to suggest the very nearest relation), others of *P. Rapæ*, and the form described by Mr. Scudder as *P. marginalis*, and afterwards by Mr. Reakirt as *P. Yreka*, can sometimes scarcely be distinguished from the varieties of *pallida*, upon which Reakirt founded his *castoria*. Do not, then, our American examples serve very powerfully to prove the common origin of all these forms, and show that we have hitherto attached too much value to what is designated a species, believing certain characters to be permanent, when, in fact, they are so only under the light of our limited knowledge? To illustrate more clearly my meaning, let us take a strongly marked and darkly colored specimen of *P. venosa* as our starting point, and we shall pass through the various stages thus, our insects becoming paler, and with the markings less pronounced, as we proceed.

1. *P. venosa*. Scud.	Veins of underside of secondaries, broadly bordered with black scales; the lines of equal width to the margin of the wings.
2. " "	Veins narrowing at the margin, with the ground color of the wings more yellow.
3. *Hulda*. Edw.	Veins with their accompanying black scales, sometimes becoming confused, and spread over the whole surface; the lines of scales being sometimes quite indistinct, at others well marked and approaching the following:
4. *Napi*. L. (Germany.)	Surface of secondaries, yellow, with the nerves bordered by black scales, the lines being narrower as they near the margin.

5.	*frigida*. Scud.	Like *Napi*, but with the whole of the lines a little narrower and fainter.
6.	*Napi*. (Colorado.)	Lines all very faint, almost obsolete as they approach the margin.
7.	*Napi*. (Massachusetts.)	Lines still fainter, quite obsolete at the margin, with the ground color of the wings still yellow.
8.	*pallida*. Scud. =*castoria*. Reak.	Ground color usually white, sometimes pale yellow, with the lines bordering the nervules, very faint or quite obsolete, passing by many gradations into the following:
	P. oleracea.	Veins without margins of scales, surface white or pale yellow.

We may pursue this still farther, until we arrive at a form of *oleracea* almost pure white, in which even the nervules themselves are scarcely to be traced by any definite color. But the subject may perhaps be better illustrated by retracing our steps, this time starting with *oleracea*, and endeavoring to show its relationship to *P. Rapœ*.

1.	*P. oleracea*.	Almost pure white, with faint yellowish tinge beneath. ♂ without spots.
2.	" " (Oreg. and N. Cal.)	White, with very faint indications of spots on the primaries.
3.	*Castoria*. Reak.	White, with faint yellowish tinge. ♂ with faint spots on the primaries.
4.	*Marginalis*. Scud.	White above, yellow beneath on secondaries. ♂ with distinct spots on primaries, and with the apex slightly dusky.
5.	*Ergani*. (Europe.)	♂ with the apex more broadly dusky, and with the spots on primaries well defined.
6.	*Rapœ*. L.	Apices broadly dusky. Spots very distinct and well defined. Underside of secondaries, white, greenish white to yellow.
7.	*Novangliœ*. Scud.	Upper and lower surfaces yellow, spots and apices as in *Rapœ*.

Thus it will be seen, that according to my views, two branches of variation have proceeded from the one original source, though what that original source may be we are at a loss to tell, and that the most special characters distinguishing these two branches belong to *P. Pallida*, which in many respects resembles *P. Rapœ* as much as it does *P. Napi*. I am aware that there are other points of difference between the extremes of these insects, but certainly none more remarkable than between the darkly veined specimen of *P. venosa*, and the almost immaculate and veinless examples of *P. Pallida*.

Breeding the caterpillars through successive generations, will alone lead us to the truth, and unhappily at present we know but little of the earlier stages of these creatures. The present remarks must therefore be taken as a suggestion rather than the dogmatic statement of a fact.

Pieris calyce. W. H. Edw.

I am inclined, from the examination of a specimen in Dr. Behr's collection, to believe that this is the Spring generation of *P. occidentalis*. Dr. Behr's specimen was taken by Mr. R. H. Stretch, in April, in Carson Valley, Nev., and mine, from which the original description was made, and which is now in the possession of Mr. W. H. Edwards, was caught by myself near Reno, Nev. in the end of March. *P. occidentalis* occurs in the same localities in May, June and July.

P. Beckeri. W. H. Edw.

This species is said by Mr. Strecker and others to be identical with the Russian *P. Chlorodice*, Hb., differing only by its larger size. In support of this opinion, I may state that in my collection are two specimens (♂) from the Coast Range in Mendocino County, measuring only 1.50 inch in expanse, while those from Virginia City are over 2.00 inches; the smaller examples in no other respect differing from the Nevada specimens.

Nathalis Iole. Bois.

This pretty little species, as well as the var. *N. Irene*, Fitch, must be included in the list of Pacific Coast Butterflies, having been taken in some abundance near San Diego by the late G. R. Crotch, G. W. Dunn and others. It is extremely abundant near Cape St. Lucas, and in various portions of the country on the eastern side of the Gulf of California.

Anthocaris Creusa. Dby.

I have little doubt, from an examination of a figure by Mr. Butler of the British Museum, kindly loaned to me by Mr. W. H. Edwards, that this species is the same as *A. Hyantis*, Edw., which is well known to occur in the Sierra Nevada, and in other high lands in this State. It is said by Dr. Behr to be far from rare in the neighborhood of Oroville, and has been taken recently by Baron d'Osten Sacken in the Yosemite Valley, and by myself near Lake Tahoe. It is probably often confounded with *A. Ausoniedes*, but is abundantly distinct.

Anthocaris olympia. Edw.

This exquisite species exists in my collection from Colorado, near the Utah border, where it was taken by Mr. Winslow Howard.

Anthocaris Reakirtii. Edw.

I think I am wholly to blame if this should turn out, as I now suspect it to be, only a form of *Sara*, Bdv., as it was entirely through my statements that Mr. W. H. Edwards erected it to the rank of a species. The main points of difference are the smaller size, the irrorations of the costa, the straight line enclosing the orange apical spot, and the white females. But I find of late years, that these characters are by no means permanent, and that all gradations may be found. It is most probable, therefore, that *Reakirtii* is the

spring generation, and *Sara* that of the summer. The former appears very early in March, and the latter in May and June. The ♀♀ of *Reakirtii* are at times, though only rarely, as yellow as those of *Sara*, and the irrorations upon the costa are as frequent in the latter as in the former.

Anthocaris lanceolata. Bdv. = *A. Edwardsii*. Behr.

In most of the males I have seen, the apices are only very slightly clouded with dusky scales, but in two specimens taken in Kern County by Mr. R. H. Stretch, they are broadly and distinctly clouded, thus more closely resembling the other sex.

Callidryas eubule. L.

Examples of this species, of both sexes, were taken in San Diego, in August, 1875, by Mrs. James Behrens, flying about the streets of the city, and settling upon the flowers of the gardens. I have since received other specimens from Mr. G. Hitchcock, of San Diego.

Colias eurydice. Bdv.

Between the spring and autumn generations of this beautiful insect a great variation occurs, which is quite constant in all the examples which have come under my notice. In the spring specimens, which may be regarded as the type, and which make their appearance in April and May, the secondaries of the ♂ are wholly bright orange, without any spots or marks upon the margin, except some brown dots to note the termination of the nervures, while the ♀ is, with the exception of the large discal spot of the primaries, and a very faint brown marginal line, quite immaculate. The autumn brood, however, appearing in July and August, have the secondaries of the ♂♂ with a black marginal border, sometimes one and one-half or two lines in width, and the ♀♀ have the margins distinctly marked with brownish patches, and occasionally (though rarely) with a black submedian band, composed of clouded patches, interrupted by the nervules, reaching from the costa to the interior margin. If deemed worthy of a name, I should propose for this strongly marked form that of

C. eurydice. Var. *Amorphæ*. Hy Edw.

I have recently received from Mr. O. Barron, of Mendocino County, a magnificent variety of this species, in which the whole of the yellow space of the primaries (which usually bears the name of the "dog's head") is suffused with the richest purple, the orange being only slightly visible beneath it, thus giving the insect a most striking appearance.

Terias Nicippe. Cram.

Taken in Kern County, by Mr. R. H. Stretch, and by Mr. Dunn and others, near San Diego.

Terias Mexicana.

Taken in the neighborhood of San Diego by Miss Marcia Crane, and near San Bernardino by the late G. R. Crotch.

Euptoieta Hegesia. Cram.

This species is very common in Lower California, and occasionally wanders over the border into this State. I have received specimens taken undoubtedly within our limits, but it must at present be regarded as a rarity.

Agraulis Vanillæ. L.

Very abundant in the gardens of San Diego in August and September. (Mrs. Jas. Behrens.)

Argynnis Liliana, n. sp. Hy. Edw.

I am unwilling to add another to the already long list of *Argynuis*, but can see no other way out of the difficulty which is presented to me by some specimens taken by me in Napa County. I have, however, much pleasure in dedicating what I believe to be a true species, to my friend, Mrs. Lillie Coit, who has added many great rarities to my collection, and at whose country residence, in one of the most charming portions of the State, the species seems to have made its home. It is intermediate between *A. Calippe*, Bdv., and *A. coronis*, Behr., partaking of the characters of both, yet I think distinct in the following details:

It is darker in color of the upper side than *A. coronis*, and very much darker than *A. calippe*, being of a rich reddish brown. The markings above similar to those of these two species. Beneath, the primaries are largely suffused with reddish brown, as in *coronis*, but the remainder of the wing is occupied by bright buff, not dull ochreous as in *coronis*. The silver spots of the margin are very decidedly triangular, and not ovate as are the apical ones of *coronis*. On the lower wings the differences are more apparent. The silver spots are larger proportionally than in any other species with which I am acquainted, while the sheen of the silver is exceedingly vivid and intense. The marginal spots are quite triangular, and the large one of the cell more decidedly oblong than either in *A. coronis* or *A. calippe*. The ground color of the wing is bright buff, inclining to orange; much the same color as in *A. rupestris*, and by no means brown as in *A. coronis* and *A. calippe*, thus giving a brighter and more lively appearance to the whole of the underside.

Without forming a *positive* conclusion as to its value as a species, I think this form well worthy of a separate name. I have taken it for three seasons past near St. Helena, Napa Co., and altogether have had before me thirty-four ♂ and seven ♀, all of which are true to their own type, presenting among themselves little or no variation. When placed side by side with long series of the closely allied species, this insect presents at once so great a difference as to strike the observer, being quite as complete as that between *A. coronis* and *A. pervadensis*. The actual position of many of our *Argynuis* as species, can only be determined, however, by watching the insects through their various stages.

Argynnis monticola. Behr. Var. *purpurascens.* Hy. Edw.

Under this name I wish to recognize the form of *Arg. monticola*, which is found chiefly in Siskiyou County, in the region surrounding Mt. Shasta, as

well as in some parts of Oregon. It differs from the type, by the larger amount of black on the upper surface, visible in both sexes, by the smaller size, and by the more suffused appearance of the lower side. The spots are somewhat larger proportionally than in the type, in this respect resembling *Zerene*. Behr, and the basal half of the secondaries is much darker in color, while the margins of all the spots are larger and more intense. The whole of the underside is also tinted with a purplish efflorescence, very visible in fresh specimens. The female is always deeply suffused with black on the lower side, and almost invariably has the spots either partially or wholly silvered, a character not observable in the typical *monticola*. This beautiful variety was first taken by Mr. W. G. W. Harford, at the Dalles, Oregon, and subsequently by Mr. J. Behrens at Soda Springs, Siskiyou County, in which last named locality I took about forty specimens, all characterized as mentioned above, in the fall of 1875. It closely connects *A. monticola* with *A. Zerene*, and may have been under Dr. Boisduval's eye when he confounded these two species.

Argynnis myrina.

Though not found in California or Oregon, this species was taken in abundance near Sitka, Alaska, by the late Mr. Bischoff. The specimens are smaller than those of the Eastern States, and the whole of the underside brighter in color, with the silver spots proportionally of a larger size.

Melitæa Leanira. Bdv. Var. *Obsoleta.* Hy. Edw.

Near San Rafael, in Marin County, I annually take specimens of a very curious variety of *M. Leanira*, so constant in its characters as to suggest the idea of a new species. In the lower side of the typical form, the secondaries are marked with black blotches near the base, and a double submedian band inclosing a series of seven spots of the pale ochraceous color of the ground. In the variety *obsoleta* these marks are all obliterated, and nothing appears but the black nervules and a slight black marginal line. In all other respects the insect agrees with the typical form. It is somewhat singular that in the locality in which these varieties are found I never met with the true *Leanira*, which is always a very local insect, and that, although I know several localities in which *Leanira* is found, it is only in the one mentioned above that I ever met with the var. *obsoleta*.

Pyrameis. Hybrid between *P. Caryæ* and *P. Atalanta.*

Hybrids among diurnal Lepidoptera are very rare, and the present is a very interesting form, worthy of record. It was raised by Dr. H. Behr from a caterpillar found feeding on nettles (*urtica*) at Lagunitas, Marin County, in July, 1876. The perfect insect appeared in August. It presents a very singular conjunction of the characters of the two species, of which it is undoubtedly a hybrid. The spots across the primaries form a bent macular band, the sub-apical spot being red and not white as in *Atalanta*, the base of the wing behind the band being rusty red. The secondaries are blackish nearly over

the whole surface, with reddish hairs, which are longest toward the base; the submarginal row of ocelli similar to those of *caryæ*, only with white pupils. The under side is that of *Atalanta*, the abdomen being neither black nor red, but brownish, the color of the anal margin of the hind wings. Altogether it is a very remarkable production of the two species, and should be figured, so that such an interesting hybrid may not be lost.

Limenitis Lorquini. Bdv.

In all the specimens I have received from Vancouver Island, the ground color of the under side has a purple tint in place of the snuff-brown of the usual form, and in two specimens received from near Virginia City, Nevada, taken by Mr. W. Eaves, I note more remarkable changes. On the upper side the white macular band is very narrow, and is edged on the secondaries posteriorly by a very distinct row of ovate orange spots, reaching quite to the costa, while inside the ochreous apical patch of the primaries, and beneath the outer band of three white spots, which is peculiar to the species, there is a duplex spot also of orange. Beneath, the wings have considerably more white than the type, and the basal spots of the secondaries are clear white and oblong in shape. I desire to record this well-marked variety by the name of *Limenitis Lorquini.* Var. *Eavesii.* Hy. Edw.

Coenonympha Eryngii. n. var. Hy. Edw.

Under this name I wish to recognize a remarkable form of *C. californica*, taken by me in considerable numbers at Soda Springs, Siskiyou County, in the fall of 1875. The upper side is exactly that of *C. californica*, var. *galactina*, wanting the black or dusky hairs at the base of the wings, the thorax and abdomen being concolorous. The under side is characterised by the usual straight band on the primaries and the waved or dentate line of the secondaries, but there is an utter absence of points, spots or ocelli, in this respect closely approaching the ornamentation of *C. inornata*. I took this insect only in one locality, flying about the beautiful *Eryngium petiolatum*, Hook, which here attains a large size, and a most brilliant bluish color.

Size of *C. californica*. Soda Springs, Siskiyou County, Cal. Hy. Edw., August. (11 ♂; 9 ♀; Coll. Hy. Edw.)

Thecla sæpium. n. var. *fulvescens.* Hy. Edw.

A very strongly marked variety of *T. sæpium* occurs rarely throughout the State. It is usually smaller than the type, and very much paler in color, being occasionally of a golden brown instead of chestnut tint. The fringes are whiter than in *T. sæpium*, the under side much fainter in color, with the markings less pronounced, and the submarginal band always more distinctly edged with white. It may prove ultimately to be a new species, but for the present I prefer to regard it as a variety of the common form alluded to.

Lake Tahoe, Hy. Edw Tehachepi Pass, R. H. Stretch. Havilah, Kern County, R. H. Stretch. (2 ♂; 2 ♀; Coll. Hy. Edw.)

Thecla melinus. Var. *pudica.* n. var. Hy. Edw.

I have before me two specimens (♂ ♀) of an insect which at first sight appeared to me a new species, but which I now think can only be considered a

variety of *T. melinus*, Bdv. It is considerably smaller than *melinus*, being only 0.90 inch in expanse, while *melinus* measures 1.25 to 1.30 inch. The upper side is similar to that of *melinus*, but the lower side is more silvery gray, with the markings in the primaries utterly obliterated, and a distinct black line at the base of the fringe. The markings of the secondaries are similar in outline to those of *melinus*, but they are extremely faint, and the anal orange spot is almost obsolete, while the red bordering to the submarginal band, so conspicuous in *melinus*, is here reduced to a few scattered scales.

Contra Costa County. Hy. Edwards. June, 1875.

Perhaps a long series of specimens will show the identity of *T. melinus*, Bdv., and *T. humuli*, Harr., but in all the examples I have seen of the latter, I miss the red scales bordering the submarginal band above alluded to. But beyond this, I see no character by which they can be separated.

Lycæna speciosa, n. sp. Hy. Edw.

Pale silvery blue, the color of *L. mellisa*, Edw. Fringes, very broad, clear white, cut very distinctly by black at the ends of the nervules. Underside, pale silvery gray, with a very minute round black spot on the costa, and a series of five round sub-marginal and one oblong central spots arranged almost in circular form on the disc. There is also a distinct oblong discal spot, and a smaller round one on the internal margin. The whole of the spots on the primaries are comparatively large, very distinct, and jet black, without white margins. The secondaries have one basal dot, a minute discal point, and a sub-marginal row of seven small black spots, also without white margins. Fringes, as in the upper side. Anterior, with the club unusually large, and the shafts distinctly annulated with white. Thorax and abdomen, blackish above, silvery beneath.

Exp. of wings, 0.70 inches.

Havilah, Kern County, R. H. Stretch. (1 ♂ Coll., Hy. Edw.)

I should have hesitated to describe this exquisite species from a single specimen, but the peculiar arrangement of the spots on the lower side of the primaries, its extremely small size, and the broad and distinctly black and white fringes serve abundantly to distinguish it from any other form with which I am acquainted.

N. B. As I intend to devote a separate article to the species of *Colias* proper, I have omitted all reference to that genus in the present paper.

Professor Davidson read a continuation of his papers on Irrigation, describing the canal Cavour.

The Committee on Nomination submitted the following report:

The Committee appointed to present a ticket of officers to the Academy to be voted for at the coming election, beg to offer the

following report. They have carefully considered the responsible duty assigned to them, and have unanimously resolved to recommend to the Academy the re-election of the present officers and Trustees. They were led to this conclusion by a consideration of the unsettled condition of the temporalities of the Academy. Many matters of grave importance, and at the same time affairs of a complicated and delicate nature have often been under consideration at the joint meetings of the Council and Board of Trustees, and it seemed to them only ordinary prudence to continue these gentlemen in office. We therefore recommend the following ticket:

PRESIDENT,

GEORGE DAVIDSON.

FIRST VICE-PRESIDENT, HENRY EDWARDS.	RECORDING SECRETARY, CHAS. G. YALE.
SECOND VICE-PRESIDENT, HENRY C. HYDE.	TREASURER, ED. F. HALL, JR.
CORRESPONDING SECRETARY, DR. A. B. STOUT.	LIBRARIAN, C. TROYER.

DIRECTOR OF MUSEUM,

W. G. W. HARFORD.

TRUSTEES,

DAVID D. COLTON,

R. E. C. STEARNS,	WM. ASHBURNER,
THOS. P. MADDEN,	GEO. E. GRAY,
R. C. HARRISON.	JOHN F. MILLER.

(Signed,)

Horace Davis, Wm. Norris, J. H. Smythe, P. B. Cornwall, S. P. Christy.

On motion, Dr. A. Kellogg and S. P. Christy were appointed Inspectors, and Chas. Wolcott Brooks and Henry Chapman Judges of Election.

MEMBERS ELECTED DURING THE YEAR 1876.

Jan. 3d.—W. B. Burleigh, Louis Nussbaumer.

Jan. 17th.—Z. W. Greene, Dr. James Murphy.

February 7th.—Dr. J. S. Crook, W. J. Graves, Gerrit L. Lansing, Dr. R. K. Nuttall, Samuel Purnell, C. L. Scudder, Joseph Tilden.

March 6th.—H. S. Craven, J. S. Curtis, E. B. Dorsey, James D. Hague, W. H. Hall, Charles Barton Hill, Louis Janin, C. W. Lightner, Alfred Poett, Howard Schuyler, W. A. Skidmore, Hamilton Smith, Jr., C. A. Stetefeldt.

March 20th.—C. F. Dio Hastings.

April 17th.—T. Bechtinger, Joel F. Lightner, S. Lubeck, J. F. Myers, J. K. Wilson.

May 15th.—Albert Arents, Louis Falkenau, C. A. Luckhardt, Emlen Painter, H. W. Reese.

June 5th.—Walter W. Dannenberg, L. L. Hawkins, Edward N. Moor, Robert Chalmers Lord.

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ERRATA.

PAGE.				
18,	9th line from	top,	for	"*melanstchthys*" read "*melanostictus*."
18,	13th "	"	"	"*Librocedrus*" read "*Libocedrus*."
18,	4th "	bottom,	"	'chalcedomy" read "chalcedony."
20,	16th "	"	"	"*Astragulus*" read "*Astragalus*."
21,	12th "	top,	"	"*Fuschia*" read "*Fuchsia*."
22,	3d "	"	"	"Zygæindæ" read "Zygænidæ."
24,	8th "	"	"	"Fuschia" read "*Fuchsia*."
27,	7th "	"	"	"Equisiti folia" read "*equisetifolia* "
38,	8th "	"	"	"*Nevadensis*" read "*Nevadense*."
38,	12th "	"	"	"*Newberyi*" read "*Newberryi*."
38,	7th "	"	"	"*Marselia*" read "*Marsilia*."
38,	9th "	"	"	"*Cyclademia*" read "*Cycladenia*."
38,	10th "	"	"	"*pulsifera*" read "*Pulsiferæ*."
38,	10th "	"	insert	"*A*." before "*Webberi*.'
38,	15th "	"	for	"*microcephalum*" read "*microcephala*."
38,	15th "	"	"	"*cecaule*" read "*algida*."
38,	16th "	"	"	"*Emmenanthus pusillus*" read "*Emmenanthe pusilla*."
38,	16th "	"	"	"*librocedri*" read "*libocedri*."
38,	17th "	"	"	"*Leucothœ Davisæ*" read "*Leucothöé Davisiæ*."
38,	18th "	"	"	"*occidentalis*" read '*occidentale*."
38,	18th "	"	"	"*cuphosbia*" read "*euphorbia*."
38,	19th "	"	"	"*scapigernum*" read "*scapigerum*."
38,	19th "	"	"	"*Pattensis*" read "*Plattensis*."
38,	4th "	bottom,	"	"Artemesia" read "Artemisia."
44,	5th "	"	"	"Bhering's read "Behrings."
44,	3d "	"	"	"*Idotœga*" read "*Idotæga*."
49,	4th "	top,	"	"*nebuloseum*" read "*nebulosum*."
49,	6th "	"	"	"*Dyadophis*" read "*Diadophis*."
49,	9th "	"	"	"forma also on" read "found also in."
49,	7th "	bottom,	"	"Echni" read "Echini."
49,	4th "	"	"	"Brickelia" read "Brickellia.'
59,	6th "	"	"	"Segnathus " read "Syngnathus."
82,	10th "	"	"	"*Sasmicossiphus*" read "*Semicossyphus*."
91,	18th "	"	"	"Tamelpais" read "Tamalpais."
91,	5th "	"	"	"*obtusioloba*' read "*obtusiloba*."
92,	15th "	"	"	"*cilliata*" read "*ciliata*."
111,	5th "	top,	"	"*Aralea*" read "*Aralia*."

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112, 12th line from top, for "*Leucothœ Davisæ*" read "*Leucothöe Davisiæ.*"

114, 5th " " " "Alfred A. Pinaut" read "Alphonse Pinart."

115, 2d " " " "*tenells*" read "*tenellus.*"

115, 6th " " " "*Rannunculus.* Eisenii" read "*Ranunculus Eisenii.*"

121, 7th " " " "demar" read "Damar."

121, 11th " " " "McGillwray" read "McGillivray."

126, 3d " bottom, " "echeneus maceatus" read "Echeneis naucrates."

130, 13th " top, " "intecinnatarite" read "metacinnabarite."

130, 11th " bottom, " "andaluriate" read "Andalusite."

130, 8th " " " "anceforsil" read "and fossil."

130, last line, for "inormtnm" read "mountain."

132, 5th line from top, for "Lithobre" read "Lithobii."

143, 8th " top, " "*Castancopsis*" read "*Castanopsis.*"

151, 9th " bottom, " "*strigosus*" read "*strigosus.*"

156, last line, " "*cristala*" read "*cristata.*"

167, 16th line from " " "*Ergani*" read "*Ergane.*"

168, 13th " " " "*Ausoniedes*" read "*Ausonioides.*"

170, 5th " " " "*Argynuis*" read "*Argynnis.*"

171, 5th " top, " "Behr" read "Bdv."